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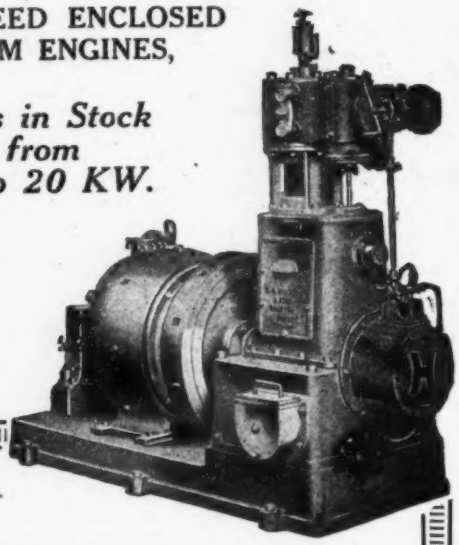

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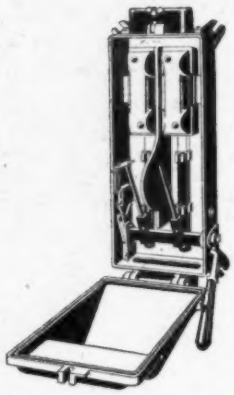

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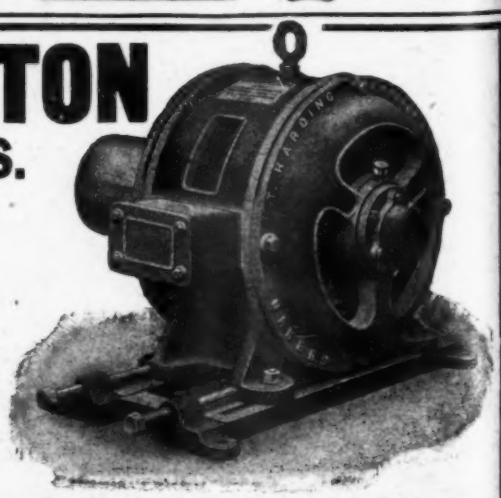

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VOL. XCV. OCTOBER 17, 1924. No. 2,447.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY, Price 6d.

Chairman: H. ALABASTER.

Technical Editor: A. H. ALLEN, M.I.E.E. *Joint Managing Directors:* G. H. ALABASTER. E. A. GATEHOUSE, M.I.E.E. A.M.Inst.C.E. *Commercial Editor:* A. H. BRIDGE.

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OFFICE: 4, LUDGATE HILL, LONDON, E.C.4.

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The Position of the German Electrical Industry.

IT would appear from the various reports that reach us that the German electrical industry, so strong and so highly organised in days gone by, is passing through a period of great difficulty. The situation is full of interest for this country for many reasons, but perhaps especially in view of the reparations problem, the loan to Germany and its effect upon her competing power, and the negotiations for Commercial Treaties between France and Germany, and Britain and Germany.

In our issue of October 3rd, in the article on the International Cologne Fair, Dr. T. F. Wall gave his impressions on the position and a prophecy of what would happen when the handicap to the development of German industries was removed. A fuller insight into that handicap and the way in which it is operating is gained from an article by Dr. A. Hamm, appearing in the *Frankfurter Zeitung*. The author cites an example of the large losses experienced by electrical concerns through the depreciation of the currency and the action of creditors in the very unfavourable year 1922-23; this particular large firm lost 15 million gold marks from these causes. But the crisis was accentuated by the incoming in recent years of many new firms far beyond the requirements. For instance, while in 1913 there were about 30 firms constructing electric motors, there are now more than 100. The new firms are small ones and they have put down works for the production of alternating-current motors, transformers, meters, installation material, high-pressure apparatus, &c. The clearing out process, which was expected in the electrical industry as in other branches, has not yet fully eventuated, and in their efforts to continue in existence these small firms are depressing prices to a very low level in the home market. As an instance of this, it is mentioned that a motor of 1 h.p. can now be obtained for

about 65 marks as compared with twice this amount ten years ago. In this way the firms which will not commit commercial suicide lose the remainder of the business, and that too, the most profitable. The only orders which remain available to them are those for non-contested business, principally large contracts, such as for big machines, transformers, high-pressure material, &c.

At the present time, says Dr. Hamm, the prices of manufactures in general are on a moderate level. According to the lists, the selling prices are about 50 per cent. above the pre-war level, but as larger discounts are allowed than in 1913 the prices are in reality only some 15 per cent. above those in 1913. Of course there is no justification for a considerable increase in selling prices; of the most important raw materials copper and rubber are at present much below the pre-war level, although cotton and iron are much higher. Dynamo sheets have had a factor of increase of 250 per cent., but the Reich Union of Industry has succeeded in bringing together a group of the iron and steel consuming industries which can offer a united front towards the similar group in the iron and steel producing industry, so as to render it easier to negotiate for the trade in the interests of consumers. On the other hand, it is noted that the efficiency of the workmen has for some time past been on the level of that prevailing in 1913, and under these circumstances it is considered that makers will be able to manage with the present selling prices.

Turning to the question of taxes, the author quotes a statement made by Herr von Raumer, president of the Reich Union of the German Electrical Industry, who has declared that the existing taxes on industry amount to as much as 10 per cent. of the value of the turnover, as compared with 0.9 per cent. in former times. Under these circumstances it is not considered clear how the electrical industry can possibly compete with those in other countries where taxation is not so heavy.

With reference to railway rates, the German electrical industry did not trouble itself about this question in former years as the cost of transport only formed about 2 or 2½ per cent. of the selling price. Special sheets were obtained from Upper Silesia for dynamos and transformers, insulating material from the district of the Rhine, and metal parts from Westphalia. The distance over which these materials had to be conveyed did not play an important part in the matter, whether the consuming works were situated in Berlin or in Mannheim. But the position of affairs is now quite different; the share of the railway rates in the selling price now frequently amounts to over 10 per cent., sometimes to over 15 per cent., and in one case (that of carbon electrodes) even to 40 per cent. A similar state of affairs prevails in accessory industries, such as porcelain works producing high-pressure material. The higher rates particularly affect the export trade. It is considered that the reduction of from 8 to 15 per cent. that has just been decided upon by the Cabinet will not make very much difference and it is suggested that unless a material concession is soon made in the rates there will be nothing left for the electrical industry to do but to embark upon a scheme of decentralisation.

Despite the burdens of taxation and of the high railway rates the export trade is advancing. During the first quarter of 1924 the exports of electrical manufactures reached 75 per cent. of the value of the exports in 1913, although the percentage has since declined. In 1913 Germany supplied 51.5 per cent. of the total world exports of electrical manufactures; in 1920 her share was only 34 per cent. and in 1921 only 21 per cent., but now it is stated that the percentage has risen to that in 1920. During the same period of years the author states that the aggregate world exports have remained almost the same; what Germany has lost has been gained chiefly by America and France.

It is interesting to read that a present-day peculiarity of the electrical industry, which bears more heavily upon the electrical industry internally than the taxes and railway rates do externally, is the number of schemes and tenders which have to be prepared. It used to be estimated that one order was received for every 20 projects prepared, but the ratio has now become much worse. The present position is that a firm requiring an electrical installation makes applications to three or four firms and gets estimates from each. So long as the information can be gathered from the catalogues and only requires copying out, this is not of much consequence, but the case is different when estimates are needed for big installations which necessitate a lot of technical work. In this connection it is suggested that American conditions should be emulated, the work being taken over by a consulting engineer in return for appropriate remuneration; in this way at the outset something would be done to prevent the inquiry being sent to several firms simultaneously.

As bearing on the question of securing economies, attention is directed to suggestions which were made recently by Herr Hissing, director of the Bergmann Company, at the annual meeting of the Central Union of the Electrical Industry. He proposed the conversion of the industry into a trust. His proposition is stated thus:—

(1) That the constructional departments of the industry should be concentrated in order to provide as far as possible simple and standardised types.

(2) That on the basis of these standardised types bulk production should be carried out to the greatest possible extent, securing cheaper production.

(3) That the buying of products for conversion into manufactures should be simplified and concentrated in order to ensure the purchase of requirements at the lowest possible prices.

(4) That the sales business should be concentrated and simplified so as to exclude the possibility of firms being played off one against another, and also to exclude mutual competition abroad.

(5) That the general structure should be organised in such a way that only uniform interests would exist.

What the director of the Bergmann company had in view, according to Herr Hamm, was the creation of a central company which would undertake the management of the departments for buying-in, constructional projects, and sales for common account, in the working results of which the participating firms would share according to a pre-arranged plan. The central company would determine the order of manufacture and would allot the orders to the individual works in such a manner as to ensure bulk production as far as possible. In return the works would receive prices according to a scheme which would only cover the working expenses so that the works would be interested in earning as much as possible on these prices by effecting improvements in manufacture. The actual profits would fall to the firms from their participation in the central company.

Organised Research.

Whilst the Department of Scientific and Industrial Research in six years has spent only £400,000 out of the "Million Fund," mainly on the formation and assistance of the Research Associations, which now number about 24, its total annual expenditure is in the neighbourhood of £300,000, and its activities have been extended to cover a much wider field than was originally contemplated. The administration of the National Physical Laboratory, the Fuel Research Board, the Radio Research Board, and numerous other Boards and Committees forms a very important part of its work, and these bodies are materially assisting in the advance of science and industry, as may be gathered from the interesting reports which are briefly summarised elsewhere in this issue. By no means least of its beneficent undertakings is the co-ordination of research with the aid of special committees constituted for this purpose in connection with physics, chemistry, engineering, &c. Obviously the next best thing to the promotion of original research is the co-ordination of investigations undertaken under other auspices, in

order to avoid overlapping and to secure the highest possible efficiency. It appears that the co-ordinating Boards go further, for in many cases they have given financial assistance to the prosecution of researches in the subjects with which they are respectively concerned, or have actually carried out investigations for other Government departments. The Physics Board has supervised the conduct of researches at the N.P.L. in connection with magnetic alloys, and is arranging for experiments to be made on pivots and jewels used in instruments, whilst it is contributing to the cost of work on the production of intense magnetic fields under the supervision of Sir Ernest Rutherford. The Chemistry Board has taken over the research into the corrosion of metals which has been conducted hitherto by the Institute of Metals, and we are pleased to see that its aim is to study the fundamental problems of corrosion in the first instance, rather than to deal with the cases that arise in practice; that is undoubtedly the right way to tackle the subject. Valuable work has been done under the ægis of the Engineering Co-ordinating Research Board, including the complete explanation of the phenomena of age-hardening upon which the remarkable properties of duralumin and similar alloys depend, and the discovery that small additions of calcium improve the electrical conductivity of aluminium containing silicon. There is no reason to suppose that pure copper must for ever remain the best conductor of electricity, or that iron will maintain its position as the most readily magnetisable metal; revolutionary changes in the design of electrical machinery may be wrought some day as the outcome of observations such as these which emanate from the laboratory. A research is to be initiated into the deterioration of the lead sheathing of cables, at Woolwich. The Radio Research Board is accumulating valuable data on the strength of radio signals received from European stations, and a method of producing accurate measured voltages of the order of one-millionth of a volt at radio frequencies has been developed, whilst apparatus for measuring radio frequencies by the "multi-vibrator" method has been completed (as already recorded in our pages), and numerous other investigations are in progress both at home and abroad, the account of the work of the Board extending over five pages.

Altogether the record of the past year's progress is very satisfactory and encouraging, and our congratulations are due to the Advisory Council on the work that it has accomplished.

The Factories Bill.

Elsewhere in this issue we commence a summary and commentary on the Bill which was introduced by the late Government for consolidating and amending the legislation affecting factories. The subject was referred to editorially in our leading columns last week, the principal proposals being reviewed generally with reference to their bearing upon industry.

While our last issue was running off the machines the debate which led to the defeat of the Government was in progress at Westminster. It might be thought unnecessary, in view of the result of that debate, to deal further with the Bill now, but while nobody can say with certainty what party or parties will be in power at the end of the present month, it may be taken for granted that the Bill, whether it be revived or not in the next Parliament, will be in the hands of those who prepare future legislative proposals bearing on the subject. Having that circumstance in mind and remembering the importance of all changes in factory regulations to the electrical and allied industries, we are publishing the full analysis and criticism of the clauses, which had been specially prepared for the Review before the Government was defeated, by an expert authority on industrial works organisation.

It may be added that the Summer Time Bill and the British Empire Exhibition Guarantee Bill are among the other matters that died as a consequence of the Dissolution. It may be regarded as a foregone conclusion that these, at any rate, will be re-introduced in the new Parliament.

Rural Electricity Supply.

In an able article which we publish to-day Mr. W. Fennell advances weighty arguments in favour of fundamental changes in the conditions which regulate, and unfortunately restrict, the supply of electricity to rural consumers. Much has been done by recent legislation to improve the situation, but much remains to be done, and the defects in the new Acts which have been revealed by experience should be removed without delay.

The author supports the case for the single-wire overhead line with earth return—the last word in simplicity and economy—which has been the subject of experiment in France, as recorded in our pages last year. This, he says, would cost about £145 per mile, and would carry a load of 40 kVA at 3,000 V. It would be no more unsightly than a telegraph line, and less so than a telephone line. Electrolysis with alternating current is negligible, and for that matter there would be few pipes or other works to suffer from it even if direct current were used. The difficulties in the way are hypothetical rather than practical—what *might* happen in the form of interference with the Post Office circuits which *might* be in the neighbourhood—and with goodwill on both sides the matter can easily be put to the test in any rural area where an a.c. two-wire line exists, by disconnecting one conductor and providing a return by way of earth plates. The cost would be trifling in comparison with the saving in expenditure that would follow the success of such a test, and the way would at once be opened for extending the benefits of electricity supply to countless country dwellers.

The Postmaster-General, as stated in the report of the Commissioners for 1923-24 (Electrical Review, October 3rd, 1924), has already agreed to multiple-earthing on a large electricity supply system, subject to specified conditions, and there would be far less likelihood of perturbation of the telegraph or telephone service in a rural area.

With this question the problem of wayleaves is bound up. It is here that the defects in the Act of 1919 are so forcibly demonstrated by Mr. Fennell, who shows that appeal to the Electricity Commissioners costs a prohibitive amount in the case of a cheap rural line. In view of the importance of developing the supply to farms, &c., the provision of all possible facilities for the erection of cross-country lines is imperatively necessary, and the solution proposed by the author—namely, that of placing the onus of appeal on the owner of the land and not on those who are engaged in a public utility service—appears to us to go far in that direction. Such a provision would not be oppressive, for the accommodation sought is of the most trivial character in most cases, and the real basis for objection is usually the desire of the owner to make something for himself; wherever there was solid ground for opposition, an appeal would lie to the Commissioners. Relief in respect of cost of construction and wayleaves is desired by all undertakers who deal with rural areas, whether municipalities or companies, and it is highly probable that a majority in favour of it could readily have been found in the late House of Commons. That the Electricity Commissioners would support such proposals we should regard as practically certain.

It is significant of the trend of progress that during the year 1923-24 the Commissioners dealt with 160 applications for leave to erect overhead lines, as compared with 95 during the previous year, all of which were granted; in 96 of these cases the applicants were local authorities, and in 64 cases companies. But only seven applications in respect of wayleaves were lodged, of which three were withdrawn; in each of the other cases consent was given after a local inquiry had been held.

The Rural Distribution of Electricity.

By W. FENNELL, M.I.E.E.

The question of the extension of electricity supply to rural areas is now being considered by the Government, and official inquiries are on foot as to the best means for securing this extension. The following additions and alterations to the existing permitted systems and regulations are submitted as being desirable, having in view the absolute need for keeping down capital cost and maintenance charges.

System.

In the first place, underground work is quite out of the question on the score of cost. One cannot lay even the smallest e.h.p. cable at less than £500 per mile. In general, the three-phase overhead system is too expensive for small quantities of power, because of the multiplication of insulators and wires; three or four wires also involve heavy and expensive poles. Single-phase must therefore be adopted for subsidiary circuits, and the strong claims of the single-wire earth-return system must be considered for the high-pressure portion of the work. The chief objection raised is that of interference with Post Office circuits.

It may be taken that few branch circuits will deliver more than 30 to 40 kVA. The earth current for a maximum load of 40 kVA will be 15 amperes at 3,000 volts, and 8 amperes at 6,000 volts, to be dealt with by the earth plate at the point of origin, and, of course, much less at each service transformer. It is admitted that such moderate a.c. earth currents at 50 cycles have no appreciable effect on telegraph and telephone circuits, if dealt with by reasonably good earth plates. Induction would be greater than with the other systems, but, as neither the current nor the pressure would be considerable, the induction effects would not be serious in ordinary cases. Moreover, such lines would be confined to country districts where there are few telegraph or telephone circuits, and as no congestion exists, there would be no need for the two routes to be parallel for long distances. For these reasons it is submitted that the earth-return system may be allowed in most rural areas without risk to the Post Office system, and with much less probability of interference than exists in towns and suburbs with tramways using earth returns. The condition must, of course, be reserved that the system be changed or the route be altered in any locality, should intolerable interference be persistent in one case, or annoying interference in a number of cases, provided the Post Office wires are properly spiralled and all reasonable care has been taken to render their system as free from interference as possible.

In connection with this question of earthing on an e.h.p. single-phase line, it was found in a certain case that, owing to a jointer's mistake during the construction of a single-phase underground line at 3,000 volts in a thinly-populated suburban area, the outer of the concentric main was not only earthed at the supply end, as required by the regulations, but also at some of the "T" boxes feeding consumers' transformers three miles away. This was in operation eight years. There is a local telephone exchange at or near each end of the line, and two railways traverse the district, but no interference with telegraphs or telephones resulted. The use of the earth as a return conductor was thus tested inadvertently for eight years under semi-rural conditions.

Line Construction and Cost.

A suitable line for rural supply may have poles about 34 ft. long by 7½ in. diameter at 5 ft. from the butt end, planted 5 ft. in the ground, with an 80-yard span; the single line wire being No. 7 s.w.g. attached to an insulator on the top. The line would be provided with galvanised iron earthing guards at each pole. The earth wire for each set of earthed metal work would be to the extent of, say, 9 or 10 turns, stapled around the bottom of each pole to form a suitable "earth plate" having considerable contact with earth and no joints. This will cost about £145 per mile, and complies with the existing regulations of the Electricity Commissioners, except as to the use of the earth as a return conductor. At a pressure of 3,000 to 6,000 volts, this would be suitable for rural and village supply, giving 1 per cent. and ¼ per cent. drop of pressure per mile respectively. A two-wire single-phase line, using the same size of conductor, would cost £245 per mile, and the drop of pressure would be nearly doubled under the same load conditions. There is no difference, so far as the safety of the public is concerned, between the two systems.

The earth-return system involves a transformer at the point of departure from a three-phase three-wire line, but this also would be required for a two-wire tapping. There would be no need in most cases to transform on a tapping from a three-phase four-wire line or from a single-phase line. The neutral or return wire would simply be discontinued for the branch or extension, and the current would return by earth to the earth plate at the point of origin.

A two-wire service should be used on the low-pressure side where the transformer is near the installation, as it would usually be, as this avoids large local currents in earth plates, but where a village is to be served, the low-pressure circuit could also be a single wire with an earth plate for each consumer or group of consumers. Now that single-phase motors of the size required by farmers are so frequently used, switched direct working on fast and loose pulleys, and as these are cheap, there is no real disadvantage for rural work in a single-phase system.

Wayleaves.

Nothing extensive can be done with overhead distributing mains until the wayleave question is put on a workable basis. The difficulty of obtaining the reasonably straight route, which is necessary for a cheap line, is notorious. Undertakers dare not use the procedure of the Act of 1919, Section 22, for obtaining a compulsory wayleave. It was tested on one occasion in connection with a proposed branch line required to cross a mineral railway. The railway company—as was usual until quite lately—demanded an underground crossing. A local inquiry was ordered; the Ministry of Transport's costs were £14, and with the parties' own costs the total would be £25. The decision was that the line must cross underground *because the line was unimportant*, and the view was expressed by the Inspector that the department should not be appealed to, except in cases which involved a substantial sum of money. There was a lack of realisation by the Ministry of Transport's Inspector and the representative of the Electricity Commissioners that it was just because the electric line was unimportant that it should, for economic reasons, be allowed to cross cheaply overhead. Apart from the cost, there is the considerable delay involved by appeal to the Commissioners.

Wayleaves are usually obtained, after explaining the public service the line will render, for a mere acknowledgment of 1s. per pole, which is double the figure usually given by the Post Office. An appeal to the Commissioners where a high rent is demanded might result in a figure of 10s., or even £1, per annum per pole being fixed, judging from decisions already given in contested cases. The news would spread rapidly, and many existing wayleaves at 1s. per pole would be cancelled by the owners, who would naturally demand the higher figure, involving the undertaking in a loss of hundreds of pounds a year on lines already erected on the basis of a mere acknowledgment. It will be seen that the more overhead lines a company or local authority had, the more serious one such local decision

would be. Many pounds are spent in altering a route, or a proposed line is abandoned, rather than pay more than 1s. per annum or risk an appeal to the Commissioners, so that Section 22 is a dead letter, except for important transmission lines. It is suggested that the Post Office figure of 6d. per pole be recognised by the Commissioners as a suburban or rural standard for electricity supply in normal cases, with a condition that any *ascertained* loss due to obstruction by poles in agriculture, &c., be paid as an extra to the tenant who suffers the loss, and not to the landowner. It may be mentioned that railway companies are, in general, most difficult in relation to wayleaves. This appears to be due to the matter being in the hands of the estate department, which is expected to extract the maximum income from rents and so-called acknowledgments. Public utility companies such as railways should be considerate of the position of other public utility services and refrain from putting obstacles in the way of non-competing services. Railways are necessarily obstructions to communications in a countryside, causing much local inconvenience, but it is not necessary that the companies should charge heavy rents for the so-called privilege of crossing the obstacles they have created. Wayleaves should be granted free from costs for preparing the so-called agreement (a printed form for which the company usually demands a guinea), and at nominal rents, to other public utility services, setting a good example to the private owner.

The Act now refers to the joint consent of the landlord and tenant. This creates a dual obstacle and is contrary to the practice of the G.P.O., which agrees with owners, whose duty it is to deal with the tenant. It is doubtful if a tenant has, as a matter of law, power to grant a wayleave, and the Act should be amended in this respect.

The most important reform required if rural lines are to be encouraged is to reverse the operation of the clause, so that the onus of appeal to the Commissioners is thrown on the owner and not on the undertakers as at present. The owner would then be as reluctant to incur the expense, risk, and trouble of an appeal as we are at present, and would grant wayleaves at a nominal rent, unless he had a very good reason for refusing. The unsatisfactory wording of the section exempting "gardens or pleasure grounds" from the discretionary powers of the Commissioners often prevents the running of a line across the back yards of cottages, irrespective of amenities or lack of them, and it makes distribution in villages difficult and expensive. This exemption from appeal to the Commissioners should be removed. The Commissioners should be as competent to decide in these cases as in others.

Fringe Orders.

It does not appear to be generally known that a "fringe order" gives an undertaker power to supply outside the area *to individual named premises only*, and that proof has to be given that each consumer desires the supply at the time the order is granted. A case may here be quoted where a cottager desires a supply. A main, in serving fringe order consumers, passes the house, but the supply cannot be given without a new fringe order, because his premises were not included in the original application.

A new type of sub-order is required which might be termed an "extension order." This would be liable to the same procedure and limitations as a fringe order, but would deal with areas. Such orders would enable undertakers with purely town areas, fixed when supply in suburban and rural areas was impracticable, to extend to outer suburbs and country districts without incurring the heavy costs and vexatious delays involved in obtaining a "special order."

Voltage Drop.

Bulk supplies are allowed 12½ per cent. pressure variation above a declared minimum under the regulations, but the distributor has to work to 4 per cent. up and down from a declared pressure under serious penalties. This state of affairs requires immediate attention, as it involves very expensive automatic boosting transformers or a breach of regulations. It must be remembered that the 4 per cent. figure was fixed many years ago on the basis of carbon lamps, where each 1 per cent. in voltage meant about 7 per cent. light variation. Now that metal lamps, much less sensitive to pressure variation, are in universal use, the figure should be altered to allow at least the same variation in candle-power as with carbon lamps. This would give a limit of 7 per cent. or 8 per cent. up and down. Even if 4 per cent. is considered a large enough variation for towns, it is not possible to keep within it for rural work when there is a long line and there are perhaps two transformers—one of them a small one with a full-load voltage drop of nearly 4 per cent. in itself—in circuit between the point of supply and each consumer. One hopes undertakers will not be expected by the authorities to accept the unpleasant position of breaking the regulations by undertaking rural work on the present voltage regulations.

Any assistance in offering the benefit of light and power to the villages, and to the numerous farmers whose interest has been aroused by the statements in Parliament, will be welcomed. While one feels that the suggested guarantee against loss in the first few years would be a great inducement, it is obvious that as the first cost can be halved without injury to anyone, by allowing earth returns, by easing the regulations, and by assuring cheap wayleaves, the subsidy will then be halved. The eventual liability to loss when the subsidy ceases will also be halved, and this will encourage undertakers to go very much further into the country than would be possible, even with a subsidy, under the present conditions.

Radio Interference Elimination—II.

By R. H. WHITE, M.I.E.E., M.I.R.E.

Acceptor and Rejector Circuits.

In the previous article* we have discussed methods of preventing the unwanted signal entering the receiver.

There are two further general methods which may be employed in the aerial and in the receiver itself.

Thus a simple closed circuit placed in series with an aerial will act as a rejector to any waves which are in tune with this circuit (fig. 1). The rejector circuit is the closed portion C L, which is inserted at a point in any existing receiving aerial.

Let us suppose that the receiver is in use for reception on 450 metres, and trouble is experienced from "jamming" on 300 metres.

*Electrical Review, September 26th, pp. 464, 465.

The circuit C L is constructed to have a wavelength of three hundred metres, and is preferably mounted inside a copper box, and other precautions taken, so that this circuit is not coupled to the receiver. L C is then tuned to 300 metres, connected in series with the aerial, which must then be retuned to the 450 metres or other wave which it is desired to receive.

The circuit L C offers little impedance to waves of 450 metres, but is nearly an infinite impedance to 300-metre waves. Such a circuit will be found of very considerable assistance in cutting out the unwanted signal. Whilst in general it is usual to connect it in the aerial, its use need not be confined to that location, as it may be inserted in any other part of the receiver which is carry-

ing high frequency currents, and may be used there alone, or in conjunction with the aerial rejector circuit.

If the unwanted signals are extremely strong, as is the case when reception is being attempted near a transmitting station, then resistance may also be added to the circuit C L, so that the energy passing into the circuit

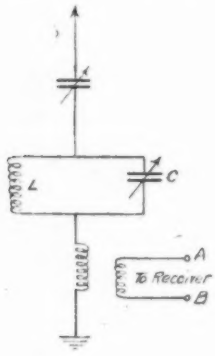


Fig. 1.—A Rejector Circuit.

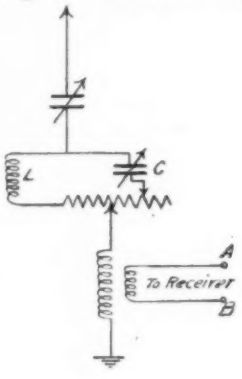


Fig. 2.—Damped Rejector Circuit.

L C may be dissipated in heat. The circuit then becomes as shown in fig. 2.

Another method of getting rid of the unwanted signal is to by-pass it to earth through a series circuit, which is again tuned to the same wavelength as that of the unwanted signal.

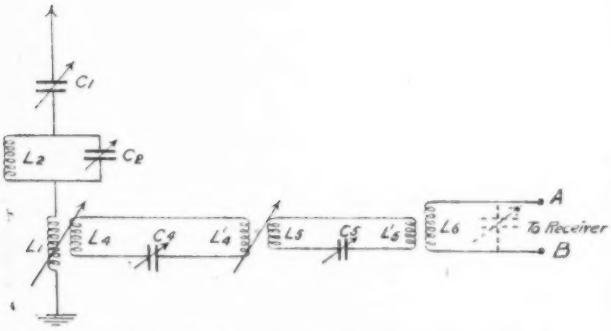



Fig. 4.—Rejector Circuit, coupled by two tuned intermediate Circuits to Receiver.

This arrangement is shown in fig. 3, where L_1, R_1, C_1 are tuned to the wave length of the unwanted signal, and so present a path of low impedance for that signal to pass to earth, whilst L_2, C_2 are tuned to the wave length which it is desired to receive. The receiver is coupled to L_2 by means of the coil having terminals A B.

It will be apparent that the arrangements described in the earlier article on tuning and balancing aerials may be combined with these rejector circuits, whilst the finer tuning which is possible with a supersonic heterodyne can be employed after the wanted signal has passed into the coil A B, figs. 1, 2 and 3.

Acceptor circuits are circuits of low resistance which are in tune with the wanted waves, and through which these waves pass on their way to the telephones. Special forms of acceptor circuits are generally known as intermediate circuits and filter circuits.

Intermediate circuits may be added externally to the receiver proper, and if of low resistance will do much to prevent any signals entering the receiver except those of the wave length to which they are tuned.

Fig. 3.—By-pass Rejector Circuit.

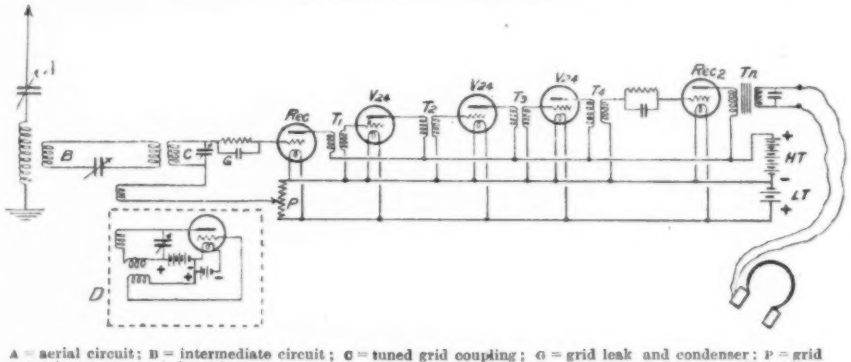
Fig. 4 illustrates a chain of two such intermediate circuits coupled to an aerial with the rejector circuit of fig. 1. Such a combination should render all ordinary "jamming" harmless, unless it is on exactly the wave on which it is desired to work, and in that case the jamming cannot be cut out if it is stronger than the wanted signals, except by balancing aerials or frames.

In fig. 4 the circuit L_2 C_2 would first be tuned to the wave length of the jamming station. L_1 C_1 would then be used to tune the whole aerial system to the wave length of the wanted station, whilst the circuits L_4, C_4, L_4', and L_5, C_5, L_5', which should be circuits having very low resistance, are both tuned to the same wave length. L_6 may also be tuned by an external condenser, or that condenser may form part of the receiver.

A Supersonic Heterodyne.

The elimination or reduction of interference may be accomplished to a very great extent by fine tuning. The ordinary tuning of a simple receiver is only relatively sharp, and can be considerably improved by making use of an independent oscillator, or heterodyne, as it is often called.

This method of beat reception is in very general use for telegraphy, as by means of the local oscillator it is possible to convert the trains of signal waves, which are at radio frequency, to trains of waves at audible frequency, and so render them fit for reception in ordinary telephone receivers. This heterodyne reception at audio frequencies is effected by generating in a local oscillator waves which differ by some 1,000 or 2,000 cycles from the frequency of the incoming waves of the signals. When this is the case, beats equal to the difference in frequency between the incoming waves and the local



A = aerial circuit; B = intermediate circuit; C = tuned grid coupling; G = grid leak and condenser; P = grid potentiometer; D = independent heterodyne; Rec = first rectifier valve; V24 = 1st, 2nd, 3rd, &c., amplifier valves; Rec_2 = final rectifier valve; T_1, T_2, &c. = intervalve h.f. transformers for 3,000 metres; T_n = low frequency iron cored transformer.

Fig. 5.—A Supersonic Heterodyne Receiver.

oscillations are produced, as in the case cited above. These will be of low frequency, and consequently audible in the telephones.

A supersonic heterodyne is simply an oscillator which produces beats which are above the audible scale, and can therefore be used in telephone reception, as the beats are too high in frequency to interfere with audible

sounds. Thus, if the incoming signals have a wave length of 300 metres, which means that they have a frequency of 1,000,000 cycles per second, and if the local oscillator produces waves of 273 metres per second, *i.e.*, having a frequency of 1,100,000, then if the circuit carrying the frequency of 1,000,000 is coupled to the circuit carrying the frequency of 1,100,000, beats of 100,000 per second will be set up. It may be remarked that any *difference* of 100,000 will produce these beats; it is not necessary that the local oscillator should work on a shorter wave; for instance, if it produces a frequency of 900,000 cycles per second, the beat frequency will still be 100,000.

Now a frequency of 100,000 is equal to a wave length of 3,000 metres, therefore these beats may be passed through a high frequency amplifier designed for a 3,000-metre wave, and if this amplifier is designed with tuned coupled inter-valve circuits, the selectivity may be made almost perfect, but with tuned circuits there is a danger of the tuning being so fine that some of the outer fringes of modulation are cut off, thus spoiling the quality of telephone reception. Resistance-wound high-frequency inter-valve transformers are therefore better for telephonic reception.

It should be understood that this method requires double rectification. The signals are first heterodyned, then rectified, then amplified, and finally the high frequency beats are again rectified before passing through the telephones (see fig. 4).

In fig. 5, A is the aerial circuit tuned to 300 metres, B is an intermediate circuit also tuned to 300 metres, C is a tuned grid coupling coil again tuned to 300 metres. The first valve of the amplifier is a rectifying valve, whilst the local oscillator D is set one or two metres above or below the incoming wave, if that wave is of the order of 300 metres, so in this case D is set to send out a wave of 273 metres.

The local oscillator D is coupled to a coil of a few turns in series with the grid of the first valve Rec. After this valve there may be one or two more stages of amplification each with its valve V24. Five of these valves are easily handled, and produce a very sensitive receiver, although for ordinary purposes one will suffice. After the stages of amplification, the last valve must be a rectifier R, whilst note magnification can be employed if desired after this to bring up the volume of the signals.

With the above type of supersonic heterodyne receiver it is desirable to enclose the long wave amplifier in a metal box, and connect this to earth, as otherwise there is a danger of picking up 3,000-metre wave interference on the coils of the amplifier itself.

The system described above is applicable to any other wave length; for instance, if reception on 500 metres is selected, the ABC circuits would be tuned to 500 metres—600,000 cycles—whilst to produce a beat of 3,000 metres, the local heterodyne will have to be tuned to oscillate at 600,000±100,000, *i.e.*, 700,000 or 500,000 cycles per second, which figures correspond to wave lengths of 430 metres and 600 metres respectively.

The tuning of the amplifier will then remain as designed, *i.e.*, suitable for a 3,000-metre wave.

Window Dressing and the Retail Electrical Trade.

By ERIC N. SIMONS.

The window is one of the electrical store's most important assets. It is a means of acquainting the passers-by that the retailer supplies electrical goods to the neighbourhood in which his shop is located, and a means of inducing those passers-by to purchase from him. Of course, the exact value of the shop window to the retailer will vary in direct ratio to the character and locality of the street upon which it looks; but however well or ill situated a window may be, good window-dressing will increase its effectiveness, and it is with the elements of efficient window-dressing that this article proposes to deal.

Let it be remembered, first of all, that there is all the difference in the world between *filling* a window and *dressing* it, and this difference is often expressed in terms of profit and loss at the end of a financial year. Unfortunately, too many electrical retailers fill their windows instead of dressing them. If the best use is to be made of the space at his disposal, the retailer must carefully follow certain definite first principles. To begin, the window must be so arranged that it catches the eye of the person who walks past it. Next, it must follow up its success in this respect by conveying a suggestion that it contains interesting objects. This done, it must create in the window-gazer a keen desire to possess the goods it exhibits. And finally, it must tempt him to go inside, either to purchase outright the goods that have attracted his attention, or to make inquiries with a view to eventual purchase.

Window-dressing is, it must be admitted, a highly-specialised task, and many of the largest retailers of electrical goods entrust the arrangement of their frontage to an expert, often paid a high salary. But the greater number of electrical retailers cannot afford to employ an expert constantly, and even if they could, do not possess the window-space that would allow him to display his abilities adequately. Far too many advocates of scientific window-dressing talk as if every retailer possessed unlimited shop-window space, and equally limitless capital. The man with a single shop has to be considered as well as the "big noise."

The electrical retailer is often hampered by the wide range of goods he has to stock. In fact, he has to give this very impression of possessing large stocks, because an ability to meet customers' requirements rapidly is one of his greatest selling advantages. Householders do not readily forgive an electrical shop for being out of stock of something they need, because electrical goods are often required in some domestic emergency when delay is irritating. For this reason alone the electrical retailer needs to give the impression that his stocks are considerable, and therefore he often has to put a good many different articles into his window.

Filling his window, as distinct from *dressing* it, means stuffing these articles unsystematically into the space at his disposal, huddled together, imperfectly ticketed, and usually uninteresting. Window-space is a fixed quantity. Only a certain amount of material can be put into it to make an effective show. Whatever goes into it over and above that amount serves only to reduce the effectiveness of the whole. In the windows of most electrical shops far too much space is given, in the writer's opinion, to standard goods. The retailer gains little by inserting these in the window. A man does not walk all the way across a road to look at lamp-bulbs or miscellaneous fittings; but a new electric toaster or electric water-heater or any other electrical novelty might tempt him to do so. In brief, the electrical shop-window should contain only those goods that meet the following definite requirements:—

(1) Are extensively advertised.

(2) Give a good margin of profit.

(3) Possess intrinsically good selling points that are likely to create interest.

(4) Have some novelty of construction, appearance, or principle.

(5) Are specially cheap or reasonable in price.

(6) Are likely to improve the appearance of the window.

(7) Are of current or topical interest.

There is much advantage in the exhibiting of well-advertised commodities, if only for the reason that manufacturers are often willing to lend help in the making of an effective display. Some, indeed, knowing the electrical retailer's frequent lack of capital and his need of special assistance in window-dressing, even go so far as to prepare complete schemes and send their own man to help in executing them. If the retailer intends to give a special display to a particular advertised or branded article, he should not hesitate to invite the manufacturer's aid. There is also the added advantage that advertised goods attract the attention of the people who have seen the advertisements.

How should the window be arranged? That, after all, is the question that has to be faced. There are five cardinal rules to be closely followed. They are:—

(*a*) Remember that window-space is cubic, not superficial.

(*b*) Remember that the eye demands relief and balance, otherwise it tires or is offended.

(*c*) Remember that attraction alone is inadequate. The attraction must be pleasurable.

(*d*) The eye should be led right to the depths of the space, then caught and held on its way back.

(*e*) Every article should, if possible, be ticketed, because nothing is more irritating to an interested window-gazer than an entire absence of information.

Some amplification and explanation of these rules is necessary for their complete comprehension.

(*a*) To some extent a shop-window resembles a stage. If the actors are to be seen at their best, there must be perspective and a good background. If plays were performed in front of a colourless lowered curtain, much of the effect would be lost. It is the same with a shop-window. If all the goods are packed into the front, if the glass is replete with folders and cards and suspended objects, so that one can only catch glimpses of the interior by peering with flattened nose through the interstices, most of the window-space is wasted.

(*b*) The eye has nowhere to rest if too many objects are crammed into the window. The electrical retailer has, in particular, to exercise great care in this respect, because much of his stock is metallic, and the competing glints and shimmers and sparkles are in themselves confusing to the eye. At the same time, there must not be too few articles in the window. What is required is a decent space between each object (presuming that it is big enough to stand by itself) and its neighbour. This gives the eye the requisite fraction of time in which to rest before passing on to fresh observational effort.

Similarly, proper balance must be maintained. It is useless to have a well-spaced collection of articles on one side of the window and a jumbled heap on the other. The front should not outvie the back, nor *vice versa*. Balance also extends to the commodities displayed themselves. Shop-windows are not catalogues, in which exact classification is essential. It is unnecessary for all the articles of one kind or price to be lumped together. The glances thrown at a shop-window are very often superficial, and often enough the gazer does not even pause. If, therefore, his eye falls on that portion of the window that contains solely low-priced or high-priced goods, he is likely to receive the impression that the shop is cheap or dear, as the case may be, being influenced accordingly. There should be variety.

(*c*) Given relief and balance in the window, the eye will be pleasantly attracted, though the window-gazer may not always be conscious that this attraction is pleasurable. At the same time, something a little more emphatic than relief and balance is needed to ensure complete and desirable attention, and to supply this a few simple tricks are often all that is necessary. The colour of the material on which the objects rest; the shape, size and design of the descriptive tickets; the arrangement and attractiveness of showcards; the grouping of packages; these are all possible elements in a striking window-display. Copper lamp-stands, for example, show up extremely well on dark oak.

(*d*) However the goods are displayed, there should invariably be a clear central space to enable the eye to pierce right through to the back of the window. By instinct the gaze seeks the most distant focal point. From the ship's deck, one's eye goes straight to the horizon, assuming that there is no intermediate object to attract attention, and only after having found the horizon does it return and search for nearer resting points. Similarly, when examining a shop-window, one looks first right to the back, then allows the eye to wander here and there among the nearer articles. To obtain full effect, therefore, nothing should be set between the eye and its natural resting-place. The main feature of the display should be set as far back as possible in the centre; in fact, right in the path of this first quick penetrative glance. The other objects should be arranged so as to catch the eye on its return.

(*e*) Every article should be clearly marked with the price (unless it is such that the gazer would be frightened, and would not therefore allow himself to be assailed by the salesman within). Many folk, it must be remembered, are too shy to go in and inquire the cost of an article, afraid that it may be more than they can afford, and disliking to confess the fact. They go by, therefore, without buying it. Descriptive labels should actually describe, and the lettering on them should be readily legible.

Some retailers adopt the practice of inserting in their windows the maker's advertising pamphlet or folder describing an appliance. This idea has its merits, but the literature must be put where it can be easily read. One shop has a folder of this sort in its window so low down that one would have to squat in order to read it. Another puts a leaflet so far back that one would require an opera-glass to ascertain its contents. This is wasting valuable matter. After all, a manufacturer's sales literature is specially written by experts to bring out the strong points of an appliance and to tempt people to buy. It is, obviously, valuable to the retailer, and should not be foolishly employed. To exhibit it without letting it say its say is hardly better than not exhibiting it at all.

This article does not profess to deal with the minutiæ of window-dressing, such as the strength and arrangement of spot-lights, the employment of elaborate settings (such as miniature kitchens), and so forth. Its aim is to indicate the main principles on which successful window-dressing rests, leaving the individual application of these principles to be made by the retailer himself.

Electricity on the Farm.—Writing to the *Irish Independent*, Mr. M. R. Heffernan, who was a delegate to the recent Assembly of the League of Nations, said he had visited a Swiss agricultural exhibition at Lausanne, and was impressed with the great use made of electric power for working agricultural machinery. In view of the projected scheme for the establishment of an electric power system on a large scale in Ireland, he held that a special study should be made of the possibilities of the application of electric power to farm work, and that a scheme should not be approved until full and careful inquiry had been made into the best manner in which it could be made available to farmers, and to subsidiary industries such as creameries. He wished to call public attention to the possibilities for agriculture in order that a hastily conceived scheme might not be adopted with a view solely to the interests of town users and manufacturers. Ireland was and must remain to a great extent an agricultural nation, and the first consideration in all such matters should be given to the possible development of the agricultural industry.

Electric Canal Haulage.—Excellent progress was reported at the recent annual meeting in Paris of the Société de Halage Electrique which operates a system of electric haulage on several of the canals in Northern France. The traffic electrically hauled during the past year amounted to 155,578,212 ton-kilometres, as compared with 105,830,287 ton-kilometres in the preceding twelve months. It was stated that on one canal system 90 per cent. of the boats are now electrically hauled, the remaining 10 per cent. being drawn by horses belonging to the boat-owners.

Electrical Service: Some Notes on its Obligations.

By ERIC G. ROSS, A.M.I.E.E.

"ELECTRICITY in Service"— so runs the slogan of the Electrical Development Association. The phrase is also prominent throughout the country in retailers' stores, plumbers' shops, wholesale and retail electrical depôts, and the like. The lay and technical Press is full of it likewise. One is tempted by the times, however, to reflect: "*What* service?" It is unfortunately the case that there exists considerable misapprehension respecting the term "service." Some may, and do, ask: "Is this 'service' not merely an advertising 'stunt,' or another money-making dodge?" The element of the money-bag cannot be ignored, it must be confessed; also the general confusion might, further, be quite traceable to a possible deliberate exploitation of the fundamental meaning of the word. The time is, therefore, opportune for some thought to be given to the elucidation of the matter.

Reference to any standard dictionaries will reveal that one phrase is common to all definitions of the word "service," and that is: "a labour for others." This definition is, however, an academical one. To convert it into one of hard practical fact it is necessary to say, not "for others," but "for others' needs." A clear understanding of this is essential if it is really desired to get down to the rock bottom of the matter. It is in the practical application of this fundamental definition that the misapprehension above referred to arises. Electricity *can* serve man. It *does* so in virtue of its *being* electricity, just as do steam, water, gas, and so on. It is the only thing that it *can* do, if properly controlled. Hence result what are known as "electrical conveniences," "electrical labour-saving appliances," and the like. *And this constitutes the basis of the usual interpretation of the word "service."* As commonly interpreted by the retailer, wholesaler, and manufacturer, "electrical service" seems to mean simply the stocking for sale of conveniences for the buying public. That is all. The magic words "electrical service" are little more than italics emphasising the fact that the public may buy electrical goods in *this* shop, and in this shop particularly.

What is overlooked, however, is the fact that electrical energy, in order to *serve*, must be *aided* to do so. It is well enough known that it can, unaided, make very large inroads upon a user's bank book, in which case it does, of course, no service whatsoever. Further, this one of its properties cannot be said to be forgotten, since the basic training of all electrical men is such as to teach them just how to *control* electrical energy. One is, therefore, led to conclude that the modern application of the meaning of the word "service" is, more or less, a superficiality; simply an advertising "stunt." Apropos, it is well to note that, during the recent World Advertising Convention at Wembley, opinion was unanimous that all true advertising is thoroughly *sincere*: not a mere "gag" to fetch in customers.

There appear to be six outstanding conditions to be fulfilled by any service, and these are:—

1.—The servant must be fully qualified to serve.
2.—The service must deal, primarily, with a continually used necessity, and only secondarily with a luxury.
3.—The service must be accepted without a grudge.
4.—It must meet the customer in all essential respects.
5.—It must be quite flexible, *i.e.*, capable of being accepted either in whole or in part, at the customer's discretion.
6.—The service must be continuous, and that up to a certain point.

An examination of these six conditions may suggest others, but such will, generally, be found to be part of one or more of those cited. It will be seen that the latter are fairly intimately connected, while, at the same time, each one apparently possesses a certain prominence. It is with this prominence that the present writer is more especially concerned as regards the electrical trade, and it will be of greatest advantage to consider mainly the domestic side of the matter, since domestic consumers are generally regarded as offering probably the largest outlet for the potentialities of electric power. At least, it is certain that it is in connection with the domestic use of electricity that the call for service is most pronounced

(1) *The servant must be fully qualified to serve.*—The truly technical mind will interpret this as implying that the servant is a good electrical engineer. This is so, but it only constitutes a certain fraction of the total qualifications necessary. In many cases, technical training is the least! However, in general, it is most important that a thorough technical training be undergone by those who would serve. Very often, this "technical training" is considered to be complete when a man sets up in business for himself after serving his trade apprenticeship, as a "contractor," or "electrician," or some such tradesman. The apprenticeship might be three years, five years, or none at all, and doubtless from an intensely private and practical point of view, such training suffices. But it is not sufficient for the purpose of service. Not only must a servant be thoroughly practical, but he must possess the ability to translate this practice into the very best of instruction for the customer; he must be trained to *observe* the customer in the fullest sense of the word; to judge just how far the latter will *accept* his service; to weigh up instantly just how the customer is going *to take* this piece of advice or that little recommendation; whether the customer considers an article to be too dear, a good job, or whether it is really necessary to have it at all; in short, he must know the hundred-and-one ways of *looking on the matter from the customer's point of view.* All this necessitates the undergoing of a training far from light. It can only be completed after many months of severely practical and tactful observation, deduction, and instruction; noting this man's peculiarity; analysing that person's aversion; carefully endeavouring to foretell another's next words; skilfully turning aside a mistaken idea; an erratic whim; and, above all, most carefully noting where *not* to make a *faux pas* of any kind. Particularly must he be careful to avoid blundering over prices. His knowledge of the firm's policy must be very comprehensive as regards these—which means more than is at first apparent. It means that the present "closeness" of many firms respecting pricing must be entirely abolished. It is useless to expect any man to serve if he is not within the confidence of the firm. If he is not, he will serve—himself first. Moreover, who has not experienced the annoyance of having to wait in a store for ten minutes while the salesman runs all over the place hunting up the manager to obtain the correct price of an article, about which there exists some doubt? Such is not service. To many firms this will sound impertinent—but necessity knows no law: if any firm *says* that it serves, then let it do so thoroughly and not by halves. In any case, if the directors do not wish their employés to know their profits, then very likely these are much too high. Any reasonable profit will stand publicity. Thus the servant must take steps (and his firm must back him up) to ensure that his training also includes a com-

prehensive course of costing, &c. A price policy cannot be properly put into practice unless *all* cost details be known by those who are actually putting it into practice.

These are a few of the main attributes which a servant must acquire. There are many more, but sufficient have been cited to show that a *servant* must lay claim to a title of much greater standing than that of wireman, or contractor. His training is probably one of the most exacting of all, which statement must be kept very much in mind.

(2) *The service must deal, primarily, with a continually used necessity, and only secondarily with a luxury.*—It is here that the term "service" is liable to be much misunderstood. It is not yet realised that, as the world progresses, electricity will become nearly as much the life of nations as water is. The time is certainly coming when all energy will be converted into electrical energy. Whatever other people may say, the electrical engineer and the scientist are fully aware of this. Hence, on the ground of *necessity*, service must be very fully, quickly, and carefully put into operation. It must be noted that the service attendant on the sale of luxuries (*e.g.*, jewellery, &c.) has as much, if not more, to do with their good selling as anything else. The simple reason for this is that people will not willingly pay highly for anything, let alone luxuries. (Here the average man in the street is referred to.) It is not yet fully realised in the electrical trade, just how little money the average man really has at his finger ends. Hence it is that the "cheap-jack," or "dud," electrical man invariably makes a fair living, much though he be reviled. People simply cannot afford to pay highly for most things. This is equally true as regards electricity and its appurtenances. Hence a line must be drawn between what is an electrical luxury and what is an electrical necessity. Broadly, an electrical necessity is that piece of electrical apparatus which will cater for a user's *actual pressing needs*, the latter being accepted as the bare essential requirements of his plane of living. Such electrical essentials are switches, fuses, cables, plugs, lamp-sockets, certain lamps, &c. No dubiety exists as to the function of those pieces of apparatus. It is when other apparatus is considered that some difficulty is experienced in finding out what of it is, and what of it is not, a necessity. The ability to differentiate accurately here forms one of the most important parts of the servant's training. It is obviously of little use installing an electric fire, for instance, if the use of it is going to prove far more expensive than the use of, say, a coal fire. However much the convenience and cleanliness of the electric fire may be accentuated, the running cost of it, combined with the first cost, *must* be less than that of any other method of heating at present in use. It is the £ s. d. that the consumer looks at primarily—indeed, almost solely. This *must* be realised fully by all who would serve. So with any other piece of apparatus. It will be seen then, that in some areas, depending on the price of electricity and other local circumstances, certain appurtenances may be classed as necessities, whereas, in other areas, the same may be classed as luxuries—purely on a financial basis, be it noted. Broadly, however, the following classification might hold:—

Necessities.—Cables, switches, plugs, lampholders, lamps up to 100 watts, plain shades, simple pendants, irons, electric kettles (occasionally), electric cookers.

Luxuries.—Lamps above 100 watts, shades other than plain, pendants (excluding simple pendants), table lamps, &c., electric fires, electric toasters, vacuum cleaners, electric fans, electric washing machines, electric cigar, cigarette, and pipe lighters, &c.

These examples do not exhaust the list by any means, of course, but they serve to indicate what is meant by electrical necessities, as distinct from electrical luxuries. The necessities cited are *continually used necessities*, which it is important to note. It is to the sale and use of these that service must primarily be given. The others are of secondary importance, as sales records actually indicate. So that, as regards apparatus, the application of service is narrowed down to within certain limits, these limits nevertheless, affording plenty of scope for human ingenuity in this matter of service.

(To be concluded.)

The London Traffic Problem.

Abstract of an Address to the Institute of Transport.

Sir Lynden Macassey, K.B.E., D.Sc., LL.D., in the course of his presidential address to the Institute of Transport, remarked that the "problem of London traffic" was a phrase that had been so reiterated as almost to leave them despondent of any, even a limited, solution. With fatalistic resignation they were prepared to associate chaos and confusion as naturally inherent in any scheme of transit and locomotion for a community so great as London.

"What the problem is" was dealt with in the first part of the address; the second portion outlined the history of London traffic, and the third the difficulties, want of system, and cause. The menace was a growing one, and in the third part the author presented a "solution"; he pointed out the need for a traffic authority, for decentralisation, street improvements, and the regulation of traffic.

Underground Railway Policy.

If tubes were to continue to be built by private enterprise to meet the growing needs of an increasing number of metropolitan suburbs, and to provide central London with what New York enjoyed ("express" underground lines running alongside the "all stations" underground railways), what ought to be the policy of the new Committee?

The author's courageous suggestion was that, first, as much traffic as possible must be collected and brought by public transit road vehicles to the suburban tube station. That was, at the best, an unremunerative local business in which no omnibus-owner would embark as a sole means of livelihood. Secondly, the tubes must be assisted to obtain the benefit, in whole or in part, of the revenue from the particular classes of traffic for which they were the means of transit best suited to cater. That involved such a basis of fares for tubes, on the one hand, and for tramways and 'buses, on the other, as tended to allocate to each means of transit the class of traffic it was best suited to carry. That meant co-operation between the owners and also implied that if, in spite of such adjustment, the public who ought to travel by the tube determined or for some reason or other were induced to travel by omnibus or tramcar, there should be such a pooling of receipts and subsequent division as gave the tube a share of the receipts from traffic carried by the 'bus or tramway which, but for the public's idiosyncrasy, the tube would and should have carried. If that policy were adopted, the author believed private enterprise would be found willing and able to provide all the tubes required by London. There was a hopeful circumstance. Extension was as vital to a tube as extension of the tube was vital to London. It was only by securing new traffic from extensions that a tube could hope to earn the interest on the heavy cost of construction through central London. Only when such a policy had been tried and failed would the author welcome any of the expedients for assisting private enterprise indicated by the Royal Commission. Should it, in the last resort, prove necessary to have recourse to such expedients, and should they prove fruitless, then, as London must indisputably have tubes, the question would arise whether the tubes should be built at the expense of the municipalities, as in New York and Paris, and worked by a company, or built by the Government and worked by private enterprise, or whether London should jettison private enterprise and leave either the Government or the municipalities to construct, own, and work the necessary tubes.

Tramways.

What place should be assigned to tramways in London's future scheme of organised locomotion? The evidence suggested that under present-day conditions with fares on a scale in reasonable relation to the current standard of wages and the cost of living, tramways were exhibiting indications that could not be neglected of their inability to remain economic self-supporting agencies of transit. It was not without signifi-

cance that certain towns, faced with the great cost of track reconstruction, had obtained, or had decided to seek, Parliamentary power to abandon parts, in some cases the whole, of their tramway system and replace them by railless trolley vehicles or motor omnibuses.

Why were tramways thus becoming unremunerative? The financial burden of the deferred repairs that accumulated during the war, the heavy costs of maintenance and operation resulting from the economic circumstances created by the war, were not *causa causans*—they had merely aggravated inherent limitations. The first was the heavy initial capital cost of the track, which exercised two direct restrictive effects: First, it confined the tramway to main traffic routes; secondly, it made it difficult, if not impossible, to extend in all directions. The second limitation was the large area of road-surface which, although used by other means of transit, the tramway was bound at its own expense to keep in repair. But that was not to say that tramways had no place in an organised scheme of city transportation. In a city of elongated rectangular area, where a vast volume of short-distance traffic had to be conveyed (especially during "crush hours") along a limited number of longitudinal main routes, tramways were the cheapest and most efficient surface means of quickly carrying a mass of traffic. Tramways could provide adequate surface facilities of transit for surface street-traffic in circular or elliptical-shaped cities of substantial minimum size up to a maximum population of 2,000,000 persons. Over that population, their ability so to do was questionable, but in cities above that size districts lying beyond the tramways' sphere of influence could only be served when the tramway system had been developed to its economic limit by projecting services of motor-omnibuses, which must carry their passengers along the main routes right through to their destinations. They were therefore economically compelled to run in competition, a condition subversive of financial stability in either undertaking and detrimental to the public.

If tramways were to be continued, then two things were essential: many overdue improvements must be provided, though the author could make no suggestion whence the money for them was to be derived; the overlapping services of tramcars and omnibuses must be worked in close co-operation and no longer in competition.

Co-ordination.

The new Committee's policy must be inflexibly directed to securing ever-increasing co-ordination of the agencies of transit.

Comprehensiveness of facility and uniformity of fare basis were the two pillars upon which must rest the ideal organisation of London transport. Were all metropolitan agencies of transport to form a single undertaking, in the hands of one responsible person, that would be the best bed-rock upon which these two pillars could be founded.

The new Act, in exempting municipal and other tramways from the slight measure of control vested in the Minister of Transport over omnibuses, had seriously restricted the power of the new Committee to co-ordinate street traffic in London.

If only the new Committee could create amongst the municipalities owning tramways in the London traffic area the will to co-operate with private enterprise, it was possible to bridge the gulf of multiple ownership, and so arrive well on the way to co-ordination.

Electrical Plant in Tibet.

The Lhasa Hydro-Electrical Installation.

It is of considerable interest that the first electrical plant to be installed in the "Forbidden City" at Lhasa, in Tibet, was manufactured in England. The installation is a hydro-electric one, and consists of a water turbine, manufactured by Messrs. Sir W. G. Armstrong-Whitworth & Co., Ltd., coupled direct to a 3-phase, 125-kVA, 500-volt, 40-cycle, 1,200-r.p.m. alternator. The machine was made by Messrs. Crompton & Co., Ltd., and is provided with a direct-coupled d.c. generator of 20 kW at 220 volts for the excitation of the alternator, and for other auxiliary work requiring d.c.

Crompton Generating Plant.

A general view of the alternator is given in fig. 1, and the special construction of the revolving field system is shown in fig. 2. The design of the field magnets follows the usual practice adopted by Messrs. Crompton for hydro-electric alternators which have to withstand test speeds from 80 to 90 per cent. higher than the normal full speed.

With this particular installation it was essential that all parts should be of the most robust character in view of the peculiar conditions attached to the installation, and the inaccessible district where the plant is installed. It was specified that the weight of individual parts should not exceed 10 cwt. when packed, it being necessary to transport the whole of the equipment about 350 miles by mules and coolies.

The plant was designed to operate continuously at a temperature rise not exceeding 35 deg. C. measured by thermometer, after a six hours' run at full load on site, corresponding allowance having to be made on test in this country for the high altitude of Lhasa.

The plant was constructed under the detailed inspection of the Tibetan authorities from Lhasa, and the greatest care was observed in ensuring that all parts, spares, &c., would be interchangeable, in view of the fact that the equipment was to be erected entirely by Tibetans, no European engineers being permitted to enter the district.

The alternator is used for supplying power to various motors, lighting, &c., and alternatively for supplying an electric furnace of the induction type.

The whole of the electric control gear was supplied by Messrs. Crompton & Co., Ltd., and comprises a standard open-type switchboard with enamelled slate panels with the usual instruments, circuit breakers, current transformers, exciter, field regulators, &c. There is also a special panel for the exciter and the d.c. feeders, and a.c. feeders for transmitting power some five miles through step-up transformers.

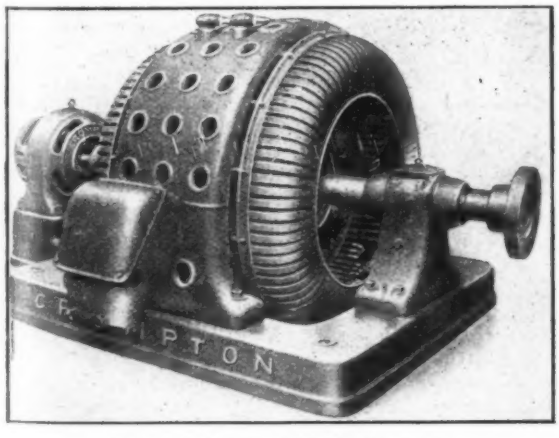


Fig. 1.—A Crompton 125-kVA Alternator.

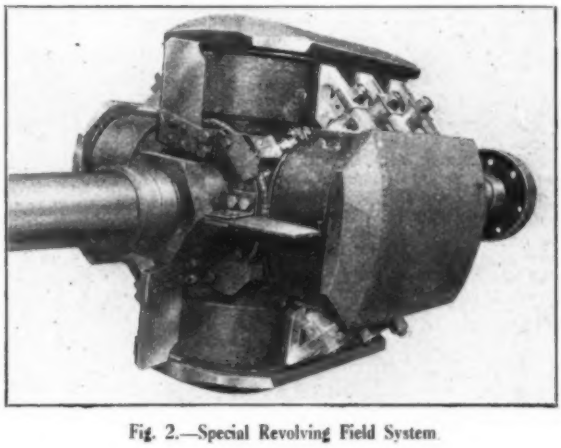


Fig. 2.—Special Revolving Field System.

Electric Steel Furnace.

The hydro-electric power is used for, amongst other purposes, driving engineering workshops which are producing agricultural implements. Great difficulty is, however, experienced in obtaining steel castings, especially for repairs, and in order to overcome this obstacle the Government of Tibet interested itself in the electric steel-making process, the outcome being that steel is to be produced locally.

According to *Eastern Engineering*, delivery was recently made of a 5-cwt. capacity Heroult electric steel furnace for use near Lhasa. The size was chosen so that a charge could be obtained in from two to three hours, in view of the fact that the power available for the furnace was limited to 125 kW

at 100 volts 3-phase and 40 cycles, and it was unnecessary to install step-down transformers in this instance as the working pressure of the furnace is from 90 to 100 volts.

All the equipment was supplied by the Electric Furnace Co., Ltd., of London, the switchgear having been made to its design by Messrs. Ferguson, Pailin, Ltd., and the furnace by Messrs. Stevensons, Ltd.

The totally-enclosed switch cubicle comprises three single-pole isolating switches and one 3-pole automatic oil switch. The instruments provided are three ammeters, one voltmeter, and a field regulator, which will be utilised for distant control of the hydro-electric generator. The furnace, fig. 3, has a mild-steel container provided with trunnions for tilting. At the back three joists carry the electrode carriages, which consist of mild-steel plates provided with runners at the top and bottom. Extension arms carry the holders, of phosphor bronze, hinged to allow the electrodes to be fitted easily. The conductor bars are insulated from the metal work of the furnace by micanite. The electrode-raising gear consists

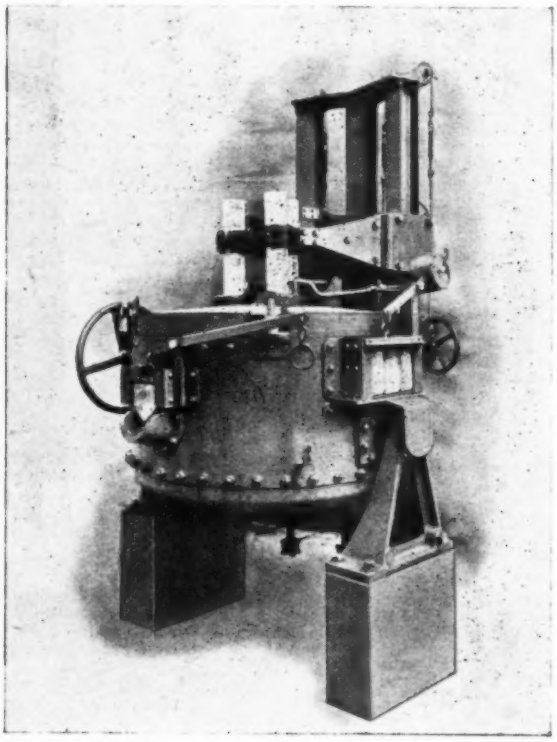


Fig. 3.—A 5-cwt. Heroult Steel Furnace.

of three sets of hand-operated worm reduction gears, one set being provided for each electrode. A cast-iron ring round each electrode just where it emerges from the furnace roof is hollow, and cooling water is circulated through it. The electrodes are 4-in. diameter graphite.

The furnace may be lined so as to be suitable either for basic or acid working, the former method being preferable when the scrap available requires refining, and the latter when pure raw material can be obtained cheaply. The bottom lining of the furnace is a solid mass of refractory. Heating is primarily by means of arcing between each electrode and the charge, the charge being connected indirectly through the earth to the neutral point of the incoming 3-phase supply. Three lamps provide a rough indication as to what is happening on each phase, and the three ammeters on the switch cubicle show the exact amount of current flowing in each phase. The furnace was designed so that it could be taken to pieces for transport up country, so that no piece weighs more than 2 cwt. In other respects it is designed on principles exactly similar to those of Heroult furnaces up to 10 tons capacity.

Other Plant.

According to the *Daily Mail* correspondent at Kalimpong, Bengal, the Tibetan Government has purchased, through its agent, Mr. Ringang Kusho, who has been trained as an electrical engineer in England, a quantity of electrical machinery, which has arrived in Kalimpong, where it is awaiting the arrival of Mr. Ringang Kusho, who will arrange for its transport to Tibet.

The only available means of transport is coolies and mules, and as some of the castings are almost a ton in weight great difficulty is anticipated. The Tibetan Government desires to harness the rivers of the country with a view to the production of electrical power.

The scheme to harness the Seesta River in Sikkim, and so supply power to practically the whole of North Bengal, has not yet materialised, but if it does, large orders for plant will probably be placed with British manufacturers.

Reviews.

Electrical Measuring Instruments. Part I. Commercial and Indicating Instruments. By C. V. Drysdale, O.B.E., D.Sc., M.I.E.E., and A. C. Jolly, A.M.I.E.E. Pp. 440, figs. 377, tables 38. London: Ernest Benn, Ltd. Price 55s. net.

Although the development of the electrical industry during the last half century has appeared to be a continuous process, close examination will reveal to the future historian that it proceeded as a series of more or less separate attacks and concentrations upon new problems as they arose. The dynamo, the arc lamp, the motor, the incandescent lamp, the transformer, the storage battery, the telephone, the cable, the coherer, the tuned circuit, and the thermionic valve, have each in turn been a main theme of discussion, and rallying points for those who within the wide limits of the profession and trade have title to be known as electricians. Thus scientific and industrial movement has followed discovery, and discovery at each stage has set something akin to fashion of thought and mode of investigation. To account for the rapidity which has given to the advance the semblance of continuity, the historian will require to note the simultaneous growth of the means which electricians have developed for scrutiny, analysis, and synthesis, whereby each discovery, at first qualitative in character, has been examined and placed almost at once upon a quantitative basis. This result has been rendered possible by the perfection attained in the design and construction of electrical measuring instruments.

During the last few years a new stage of development has been reached. There is still concentration upon the newer discoveries, but there is far closer relationship between the various parts of the theory and the principles of design of apparatus, machines, and plant, and again it is the superb instruments and methods of measurement that impart to the results stability and unity. The time is therefore well chosen for a review of the science, art, and craft of electrical instrument-making, and it is fortunate that two writers so well versed in the subject as Dr. C. V. Drysdale and Mr. A. C. Jolly have been able to collaborate in this task. They have produced a book that gathers into a focus most of what is best worth remembering of past and existing forms of commercial and indicating instruments, and that throws forward considerable light to aid in the advance towards new designs.

There will be disappointment in the hearts and minds of certain would-be possessors of the book, because of its high price (55s. net), and there will be disapproval by others because the present volume, Part I, deals almost entirely with direct-indicating instruments, and therefore leaves out of account the description of laboratory types which to some readers are the more instructive and attractive. Part II, which is in contemplation for the treatment of laboratory instruments, *may* appear, however, if Part I meets with favour. Readers and reviewers who appreciate Part I will thus in their dilemma be constrained to pass as lightly as possible over the objections arising from cost and incompleteness, for in no circumstances must the authors be deterred from finishing what they have so well begun.

With these reservations it may candidly be stated that Part I contains a generous list of items, and that the average reader will find most of what he requires in these 440 pages of text. The authors describe in a scholarly and adequate manner the electrical principles involved in instrument work, the conditions for effective working and for rapid indication, and the properties of materials that enter into construction; and they single out dynamometer-ammeters, voltmeters, wattmeters, hot-wire indicating instruments, and electrostatic commercial instruments for special consideration. Here is the technical information needed for comprehension of the subject. All that is required to enhance the value of this treatment is some practical advice with regard to the best means of co-ordinating the processes of design, construction, and testing, to produce the best results.

The whole of the text, including the mathematical work, is clearly expressed and bears the stamp of accuracy and consecutive arrangement. Some of the chapters, for example those on conditions of rapid indication, soft-iron instruments, and hot-wire instruments, will appeal especially to teachers and designers. The chapter on electrostatic instruments is excellent so far as it goes, but it naturally lacks the particulars that can only be inserted when laboratory apparatus is to be described. For a similar reason there are necessarily gaps in the historical references throughout the book. The drawings, illustrations, and printing are of very high order, and are entirely worthy of a treatise that, when completed with Volume II, must be regarded as a standard work.

To many these pages will recall a long procession of types of measuring devices, each of which in its day seemed likely, with minor improvements, to assume permanent shape. One by one they have been superseded; some because they were too delicate, some because they were too elaborate, some because they were too slow, some because they were inherently faulty. The general principles of design have been mastered, and there has been a movement towards accuracy, robustness, dead-beatness—if the word may be permitted, and towards securing rapidity of yielding the result, an open scale, and the advantage of being direct-reading, while the whole is compact, fairly light, and portable. It may also be said that in

some respects with greater efficiency has appeared greater simplicity. Nevertheless, there are indications that finality in design is still remote. Indeed, there are indications that we are approaching yet another phase of electrical measurement. The old principles will, however, remain and the younger school of electricians may congratulate themselves upon being prepared for the study of the complex problems that await them by teachers so skilled, experienced, and trustworthy as the authors of this masterly treatise.

Atoms and Rays. By SIR OLIVER LODGE, F.R.S. Pp. ix+208; figs. 8. London: Ernest Benn, Ltd. Price 21s. net.

Sir Oliver Lodge is a veteran of the old school who, as he has himself acknowledged, adjusts his mind with difficulty to the new teaching that has arisen in the science of physics since the opening of this century. His present book, introducing modern views on atomic structure and radiation, should therefore be of special value to others in like predicament, of whom there are many. He asks his readers to treat the book as a stepping-stone to the more advanced treatises, such as those furnished by Andrade, Kramers, Bohr, and Sommerfeld, and he expects it to be read rather as a recreation than a task: that, however, must depend on who reads it. He hopes, in any case, it may serve to render the fundamental truths of physics better known to the public generally. The popularisation of scientific truth is a very protracted process, as he admits; the general public is apt to lag a century or so behind the pioneers of scientific discovery. Nevertheless the main facts of astronomy are now in possession of the people and available for literary allusion and illustration in a way that testifies to a broader outlook of the general public, and he hopes his contribution to the number of publications on the new physics will hasten and help to bring about a similar condition of things for this department of science also.

The universe is composed of electrons and protons, very widely space so that if those that compose the body of a man could be placed in contact, the bulk would be no bigger than a grain of sand—a small grain at that, and one very difficult to handle, its weight would cause it to sink through most substances. Insulators are bodies in which the electrons are all fixed; conductors are bodies which contain free electrons or electrons that are but loosely attached; a current of electricity is a current of electrons speeding through the wide and open spaces of matter. So long as the flight of electrons proceeds evenly, magnetic force surrounds the path of each; but, when their flight is interfered with, a ray emerges, and the times and the places at which the effects of this ray appear, are related in a fixed proportion which corresponds to the velocity of light.

One of these days perhaps our text-books will be able to proceed, from such simple beginnings as these, to give a clear and succinct account of all natural phenomena; but at present it is best to begin with the phenomena first and explain historically how it is we have been able to arrive at conclusions so extraordinary as belief in the existence of electrons and protons involves. And this is what Sir Oliver Lodge has found it expedient to do. He traces the disentanglement of spectral lines from Dr. Johnstone Stoney, through Balmer, to Bohr, and then attempts an illuminating reconstruction of the steps by which the latter arrived at his wonderful solution. This solution is illustrated by apt analogies from astronomy. Thus, a shot fired horizontally at a velocity of five miles per second would describe an ellipse about the centre of the earth, if there were no matter to obstruct its path, and just double this amount of energy would be required to carry it out of the sphere of the earth's attraction. The speed of an electron circulating in the innermost orbit of the hydrogen atom is moving at 1,300 miles per second, and this is half the energy it would acquire, under the forces of electrical attraction, in penetrating the atom to this distance, from the outside. He ends with the statement: "... we are living in the dawn of a new kind of atomic astronomy which looks as if it were going to do for chemistry what Newton did for the Solar System." There are probably few of our readers who would not be as well able to beguile the tedium of a railway journey with this book, as by any of the time-killing devices usually purveyed for that purpose, and it would certainly afford them more lasting satisfaction.

The Amateur's Book of Wireless Circuits. By F. H. HAYNES. Second edition. Pp. 124. 117 circuit diagrams. London: The Wireless Press, Limited. Price 3s. 6d. net.

Mr. Haynes from his experience as assistant editor of the *Wireless World and Radio Review*, is well qualified to cater for the needs of the amateur experimenter, and foremost amongst these needs is a collection of diagrams of practical circuits with concise explanatory notes as given in this book.

The great bulk of the circuits are naturally receiving circuits, but a number of simple transmitting circuits are also given for the comparatively small but enthusiastic body of transmitting experimenters.

The diagrams are all of what may be called useful circuits, clearly drawn, and the notes are conveniently placed on the same page as the circuits to which they refer, those circuits which are easy to make up and manipulate being marked with an asterisk.

In addition to the diagrams and notes, 18 pages are devoted to the properties and operation of circuits, and some useful tables connecting inductances and capacities with wave-lengths are also included.

A table of contents or index to facilitate reference might have been added with advantage.

Business Notes.

Bankruptcy Proceedings.—N. A. WALLIS and A. R. WARD, trading as Wallis Ward, 29a, Leslie Park Road, East Croydon, electrical engineers.—The first meeting of creditors was held on October 10th at 29, Russell Square, W.C.1. The statement of affairs showed liabilities of £241 against net assets of £1 17s. 6d., or a deficiency of £239. Debtors attributed their failure to lack of capital, depression in trade during the summer of 1923, loss incurred through undertaking contracts at too low prices, and law costs of proceedings against them. They commenced business in August, 1922, in verbal equal partnership at their present address as electrical engineers, with stock estimated at £15, but owing to lack of capital they found themselves unable later to complete two contracts which they undertook for the wiring of houses. Being unable, also, in August, 1924, to pay rent of the workshop and office, amounting to about £6, they left the premises and handed the key to the landlord. Since the end of 1923 they had been under pressure by creditors. They became aware of their position in January last. Debtor N. A. Wallis stated that he was formerly in partnership with another from January, 1919, to July, 1922, in an electrical engineer's business. His former partner provided £150 capital, and debtor contributed his practical knowledge. The partnership was subsequently dissolved. The case being a summary one was left in the hands of the Official Receiver as trustee of the estate. The following are creditors:—

	£		£
Collins, E.	20	Roper, H. E	25
Falk, Stadelmann & Co....	160	Wenham Lighting Co. ...	15
Kimber & Son	15		

L. HOLMAN, electrician, 11, Camden Road, Bridgwater.—Trustee, Mr. F. W. Darley, Official Receiver, 26, Baldwin Street, Bristol, released September 26th.

C. WRIGHT and H. WRIGHT, electrical engineers, 251, Fulham Road, S.W.—Last day for proofs for dividend, October 29th. Trustee, Mr. W. Strachan, 50, Gresham Street, E.C.2.

L. A. RADFORD, electrical engineer, 50, Welford Road, Leicester.—Last day for proofs for dividend, October 25th. Trustee, Mr. E. Barlow, Official Receiver, 1, Berridge Street, Leicester.

G. A. MORLEY (A. Whale & Co.), electrician and wireless engineer, 201, Powis Street, Woolwich, S.E.—First and final dividend of 2s. 9d. in the £, payable October 29th, at the Official Receiver's office, 29, Russell Square, W.C.1.

B. ROSE, electrical dealer and hairdresser, 10, Broughton Lane, Manchester.—Receiving order made October 3rd, on debtor's own petition.

W. G. BAYMAN, electrical engineer, 86, North Side, Wandsworth Common, S.W.—Receiving order made October 7th, on debtor's own petition.

L. BACKHOUSE, C. H. THORNTON, and S. EVANS (Arc Electrical Co.), electrical and wireless suppliers, Palatine Buildings, Victoria Street, Manchester.—First dividend of 5s. 6d. in the £, payable at the offices of the Trustee, Mr. A. T. Eaves, 15, Fountain Street, Manchester.

J. F. GUEST (L. D. & J. Guest and Guest & Robinson), plumber, electrician and hardware dealer, 97, Great Horton Road, and Barker End Road, Bradford.—Receiving order made October 3rd on debtor's own petition. First meeting, October 17th, at the Official Receiver's office, Bradford. Public examination, November 3rd, at the County Court, Bradford.

Company Liquidations.—COMMERCIAL ELECTRICAL ACCESSORIES, LTD.—A meeting of members is called for November 18th, at Bush Lane Chambers, 26-27, Bush Lane, Cannon Street, E.C., to hear an account of the winding up from the Liquidator, Mr. N. Bell.

CATCHPOLE & MAURICE, LTD., 59-61, New Oxford Street, W.C.—Last day for proofs for dividend, October 25th. Mr. H. E. Burgess, Senior Official Receiver and Liquidator, Carey Street, W.C.

TIDD, SIDAY & CO., LTD.—Winding up voluntarily. Liquidator, Mr. J. Y. Finlay, Finsbury Court, Finsbury Pavement, E.C.—Meeting of creditors, October 21st, at Finsbury Court. Particulars of claims to be forwarded to the Liquidator by November 11th.

Capital Reduction.—THOMAS A. EDISON, LTD., and Reduced.—A petition for the confirmation of the reduction of the capital of this company from £50,000 to £12,500 has been presented to the High Court, and will be heard on October 21st.

Dissolution of Partnership.—Dawson & Cohda, wholesale electrical suppliers, factors, and engineers, 132, Vicar Lane, Leeds.—Mr. J. Cohda and Mr. F. Dawson have dissolved partnership. Mr. Dawson will attend to debts and continue the business in his own name at the same address.

Trade Announcements.—The Creswick, Dixon Electric Co., of Sheffield, is opening premises at Electric House, Knifesmith Gate, Chesterfield.

The business of Turner & Walton, electrical engineers, 29, Blackburn Road, Great Harwood, is being carried on by Mr. J. H. Walton, to whom communications should be addressed. The dissolution of the partnership of P. C. Turner and W. P. Walton was announced some weeks ago.

Mr. S. W. Walker has opened a wireless business at 47, Jewry Street, Winchester.

Messrs. Colebourn & Kermode, wireless engineers, have opened new premises at 5, Castle Street, Douglas, Isle of Man.

Messrs. Martin & Brown, radio engineers, have opened premises at 46, Chapel Street, Hamilton.

Messrs. Temple, wireless engineers, have opened new premises at 62, Carlisle Street, Goole.

The County Electrical & Wireless Stores, Ltd., of Deal, has opened a branch business in High Street, Folkestone.

The business of Mr. W. R. Less, dealer in wireless accessories, 46, Old Town Street, Plymouth, has been transferred to Messrs. W. G. Heath & Co., 41, George Street, Plymouth.

Messrs. W. G. Dodd, Ltd., of Ayr, have opened a branch shop at 30, Templehill, Troon, where they will be pleased to receive the latest electrical catalogues.

Catalogues and Lists.—Messrs. A. W. Beuttell, Ltd., 53, Victoria Street, London, S.W.—Illustrated and priced leaflet (No. 24) of "Linolite" reflectors for showcase, shop window and other lighting.

Messrs. Ferranti, Ltd., Hollinwood.—Illustrated descriptive pamphlets:—No. Ta152: oil-immersed static transformers, type FTR; No. Ta155: oil-testing equipment; No. Ta173: externally-operated oil-immersed tapping switches.

Fuller's United Electric Works, Ltd., Woodland Works, Chadwell Heath, Essex.—List No. 315B, 24 pp., containing brief illustrated particulars and prices of various new Sparta radio accessories; Folder 321 describing a new Sparta crystal set.

Artistic Shade Co., 146, Kensington High Street, London, W.8.—Hand-painted catalogue of lamp shade designs for decorative lighting schemes; also a selection of samples of materials therefor.

The Medical Engineering Co., 71a, Englefield Road, London, N.1.—Priced circular relating to d.c. and a.c. centrifuge motors.

Ena Electrical Appliances, Ltd., 62, Englefield Road, London, N.1.—Priced circular dealing with the "Ena" electric stove.

Messrs. J. H. Tucker & Co., Ltd., King's Road, Tyseley, Birmingham.—Copy of their complete catalogue, consisting of a number of separate sections excellently produced, using art paper throughout and having different coloured covers for each section. The sections are:—Lampholders and china ware; plugs and sockets; flat tumbler switches; flush tumbler switches; dome tumbler switches; fuse and distribution boards; switchboards and components; ironclad switches and fuses; also one containing prices for the products included in the whole of the foregoing sections. We learn that approximately half-a-million more Tucker switches were sold last year than in the preceding year.

Metropolitan-Vickers Electrical Co., Ltd., Trafford Park.—Illustrated pamphlets each of 8 pp.; No. 400/1-1 describing induction regulators and referring to typical applications; No. 40/3-1 describing large vertical induction motors.

Autocar Electrical Equipment Co., Mitchell Street, London, E.C.1.—Card tabulating sizes and prices of "Westool" standard commutators and car-lighting dynamos for English, American, and Continental automobiles.

Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester.—Illustrated and priced catalogue dealing with Exide batteries for wireless work. The tables dealing with the characteristics of valves, the curves and tables dealing with types of batteries for various valves, the notes on the care of batteries, and the chart of wavelengths are informative, and provide information not usually to be found in this class of publication.

Messrs. James & Frederick Howard, Ltd., Bedford.—An illustrated brochure describing the firm's agricultural machines, steel rails, contractors' wagons, &c.

The Wainwright Manufacturing Co., Ltd., 531, Forest Road, Walthamstow, E.17.—A sheet illustrating "W. & M." radio components, together with a price list of these.

Messrs. W. T. Glover & Co., Ltd., Trafford Park, Manchester.—An illustrated pamphlet dealing with lead service boxes for cables up to 0.25 sq. in. (4-core).

Messrs. Siemens Bros. & Co., Ltd., Woolwich.—Catalogue 190, describing the company's ebonite, and giving full particulars as to unit weight, &c., of sheets, rods, tubes, &c., and details of special mouldings.

Mr. Frederick Pratt, 66, Victoria Street, S.W.1.—Publication No. WB110, containing details and prices of Peto and Radford accumulators.

The Wholesale Fittings Co., Ltd., 23-27, Commercial Street, E.1.—An illustrated and priced catalogue of radio accessories and components of all kinds.

The Relay Automatic Telephone Co., Ltd., Marconi House, Strand, W.C.2.—A mailing card advertising the company's installation renting system.

The British Thomson-Houston Co., Ltd., Crown House, Aldwych, W.C.2.—Pamphlet R7441A, dealing with the "Type B5" radio valve. Illustrated and priced. Illustrated leaflets relating to the Tungar battery charger and X-ray reflectors for shop-window lighting.

Vickers & International Combustion Engineering, Ltd., Africa House, Kingsway, W.C.2.—A circular letter setting forth the advantages of the company's system of providing complete power undertakings, together with a list of contracts in hand.

Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, S.W.1.—October list of motors and dynamos in stock at the company's Charleroi works.

Local Exhibitions.—Barrow.—An "Electricity in the Home" Exhibition is being held by the Barrow Corporation Electricity Committee in conjunction with Messrs. Tounson and Ward, Ltd., Barrow. The artistic effects of modern electric lighting and heating in the home are shown, and demonstrations given in electric cooking, sewing, washing, and cleaning.

Latham-St. Annes.—An exhibition of electrical appliances has been opened in the Ansdell Institute by the Corporation.

Bromsgrove.—At the Parish Church Hall, Bromsgrove, there was opened on Tuesday last (it will close to-day, Friday) an exhibition demonstration of electrical appliances and service for the home and business. This is one of the series of demonstrations organised by the Shropshire, Worcestershire, and Staffordshire Electric Power Co.

Sydney Municipal Contracts.—The State Government having refused to appoint a Royal Commission to inquire into the practice of certain firms in connection with contracts for electrical equipment, the Finance Committee of the Sydney City Council has recommended the Council to request the State Premier to send to the Prime Minister of Australia the papers relating to civic contracts with a view to appointing a Federal Royal Commission. That the two electrical firms in Sydney should be debarred from tendering to the City Council for two years, provided that the city solicitor reports that the Council can legally take such action, was, according to the *Sydney Daily Telegraph*, a majority decision at a recent meeting of the City Council.

Unemployment.—The number of persons recorded on the registers of employment exchanges on September 29th, 1924, in Great Britain was 1,198,800. This was 18,510 more than on September 22nd, 1924.

Electrical Dispute: Decision.—The *Financial News* states that the Industrial Court has considered an objection by the Electrical Trades Union that Decision 728 should be applied by the Metropolitan Railway Co. to its members. The court has decided that the company has been justified in applying the decision.

Capetown Strike Ended.—Our Capetown correspondent reports that the strike in the building trades, to which the Electrical Trades Union is affiliated, ended last month, after having been in progress for over six weeks. The men have returned to work at the old rate of wages, and the dispute is to be referred to a National Conciliation Council, representing employers and employés for the whole country. If this council cannot be formed within six months the employers are prepared to go to arbitration. One effect of the settlement of the strike will be that the wages will be standardised, and it will be compulsory on employers to pay the standard rate or be liable to prosecution. The fact is much appreciated by both sides, especially in the electrical business, as many unscrupulous employers have, in the past, employed incompetent assistants, often coloured men, at a low rate of wages, and have thus been able to undercut firms of repute.

Coal Pulverisers for Melbourne.—The Melbourne City Council has placed an order with Messrs. Alfred Herbert, Ltd., for two "Atritor" self-contained pulveriser units for its electricity undertaking. These pulverisers, which are to be employed in firing two B. & W. boilers, will incorporate the standard features of metal separators, coal driers, pulverisers, and blowers, thus obviating the use of separate driers and the storage of the powdered fuel.

Our Foreign Trade.—September Figures.—The following were the values of imports and exports of electrical goods and machinery during September, 1924:—

	Sept., 1924.	Inc. or dec.	9 months 1924.
Imports—			
Electrical goods and apparatus	£328,395	+£111,167	+£527,452
Machinery	799,352	+ 34,497	+ 779,000
Exports—			
Electrical goods and apparatus	852,679	+ 170,485	+1,173,707
Machinery	3,613,253	+ 205,636	−1,064,393
Re-exports—			
Electrical goods and apparatus	15,917	+ 6,553	+ 45,245
Machinery	100,736	+ 11,037	+ 122,531

Late Shop Lighting.—During the last three years the E.D.A. has advertised extensively in a large number of national retail trade journals the advantages accruing to shopkeepers from the late lighting of shop windows. It is hoped to embark upon a similar campaign in the course of a few weeks. E.D.A. has issued a booklet and mailing cards for distribution in connection with this campaign, and will be pleased to provide them at low charges per 100 or 1,000.

Large Telephone Batteries.—The Chloride Electrical Storage Co., Ltd., has in hand some very large stationary batteries for telephone operation, including an order from the Automatic Telephone Manufacturing Co. for a battery of four sets each of 25 cells, having a capacity of 10,000 ampere hours (10-hour rate), for the G.P.O. Holborn Exchange. This, it is claimed, will be one of the largest telephone batteries in use in the United Kingdom. A special feature of the design will be the supports for the cells, which will consist of stoneware pedestals in place of the usual wood stillage. This not only gives high insulation, but enables the battery-room to be washed round by a hose-pipe, thus affording a greater degree of cleanliness. The company also has in course of manufacture a similar type of battery, comprising two sets of 25 cells, having an initial capacity of 8,000 ampere hours and an ultimate capacity of 10,000 ampere hours, for the Bishopsgate Exchange. The Western Electric Co., Ltd., has placed an order for the whole of the stationary batteries which will be required for the new Tokio telephone exchanges.

Heaters for Motor-car Radiators.—Referring to our footnote to "Radiator's" letter in our issue of October 3rd, the Midland Electric Power Installation Co. informs us that the heater mentioned has proved very successful for the purpose, keeping the water quite warm and facilitating starting on the coldest morning; but it is not suitable for running off the car battery, as it takes 60 watts. It is made for all supply voltages and all types of car.

Australian Electrical Associations Amalgamate.—According to the Sydney *Daily Guardian*, a new and strong organisation has resulted from the amalgamation of the Electrical Contractors' and Electrical Employers' Associations, which has been recently effected. Eighty new members have been elected to the re-created association, which still retains the name of the stronger body—the Electrical Employers' Association. An offshoot of the new association is the committee which has been formed to look after the interests of members of the wireless section of the electrical trade. To celebrate the formation of the new association a dinner was held on August 21st. Mr. N. Phelps Richards is secretary of the Association.

Lead.—Messrs. James Forster & Co. report that the rise since the beginning of the month of about 30s. a ton is ascribed to large purchases by Germany of American bonded lead for shipment this month and next, and it is anticipated, therefore, that there will be a corresponding shortage here. "So far this has not been borne out, arrivals this month in London and Liverpool being quite up to the last three months' average. Demand from consumers has been very moderate, and there is no doubt that the cable manufacturers in particular are not nearly so busy as they were during last autumn. Most consumers also are quite comfortable with regard to supplies and can afford to wait for lower prices."

A Hong-Kong Contract.—The Civil Engineering Contracting Department of Sir W. G. Armstrong, Whitworth and Co., Ltd., have secured a contract (value £126,250) for the first section of the Shing Mun Valley waterworks scheme for the Public Works Department, Hong-Kong. It involves the construction of a small intake dam on the Shing Mun River, the making of conduits, the construction of two tunnels, having lengths of 2,000 ft. and 4,000 ft., and the laying of pipes, &c., to provide nearly three million gallons of water per day.

The B.E.A.M.A. and a Proposed Exhibition at Glasgow.—The secretary of the British Electrical and Allied Manufacturers' Association has written to Glasgow Corporation intimating that, in the event of the Corporation deciding to proceed with the promotion of an exhibition before the result of the British Empire Exhibition is known, his Association would not be in a position to promise the Corporation any support, but in the event of the Corporation being able to name an approximate date before which the proposed exhibition would not be held, if such a date were sufficiently remote from 1924 to leave members unaffected by the result of the British Empire Exhibition, his Council would be prepared to give the proposal full consideration. Mr. D. A. Bremner, director of the British Engineers' Association, intimated that many of the members of his Association, who had been put to great expense in exhibiting creditably at the British Empire Exhibition, were greatly concerned at the prospect of exhibitions on a large scale being held in Glasgow and Edinburgh in the not very distant future. Mr. Bremner expressed the hope that before exhibitions, in which they were expected to participate, were promoted, they would be consulted.

The Town Clerk reported that he had informed the Associations that in the meantime only preliminary matters were being considered, and that before any decision as to holding an exhibition was come to, the views of those, including trade organisations, likely to be interested in the subject, would be ascertained.

Book Notices.—"*Proceedings* of the Rugby Engineering Society." Session 1922-23. Rugby: The Society. Price 10s. 6d.—This volume contains reports of meetings, a list of officers, and a number of papers. The last include "Steam Turbine Blading," by Mr. J. C. Read, B.Sc., "Magnetism," by Dr. T. F. Wall, "Electric Propulsion of Ships," by Mr. W. J. Belsey, &c.

Messrs. Chapman & Hall's Autumn List contains, in addition to numerous works of general appeal, several technical treatises. These include "The Mechanical Design of Overhead Electrical Transmission Lines," by E. T. Painton, B.Sc., "Alternating Current Rectification" by L. B. W. Jolley, M.A., "Electric Vehicles," by C. W. Marshall, B.Sc., &c.

"Faraday House Journal." Vol. XI, No. 1, Michaelmas Term.—In addition to the usual notes and notices, book reviews, &c., this issue contains an unusual number of articles, including "Notes on the Starting of Single-phase Induction Motors," by B. J. Rowe; "The Coal Equivalent to Water Power," by H. E. M. Kensit; "The Bruce Peebles Automatic Motor Converter," by G. S. Buckingham; and "Testing and Treating Power Plant Feed Water," by H. Rainford.

"The Waste of Capitalism." Report of the Committee of Inquiry into Production, &c., set up by the National Joint Council, representing the Trade Union Congress General Council, the Labour Party Executive Committee, and the Parliamentary Labour Party. London: Labour Joint Publications Department. Price 1s. 6d.

"Laxton's Builders' Price Book," now in its 132nd annual edition, and "Lockwood's Builders' Price Book," now in its 60th annual edition, are to be amalgamated to form one comprehensive work, with the title of "Laxton's & Lockwood's Builders' Price Book," under the management of Kelly's Directories, Ltd.

The McGraw-Hill Publishing Co., Ltd., has issued a list of books on mechanical engineering subjects. These cover thermodynamics, engine and boiler construction, mechanical stokers, power plant chemistry, air compression, &c.

"Small Electric Generating Sets Employing Internal-combustion Engines," by W. Wilson. Pp. 161; figs. 60. London: Ernest Benn, Ltd. Price 18s. net.

"Post Office Electrical Engineers' *Journal*." Vol. XVII. Part 3. October, 1924. London: The ELECTRICAL REVIEW, LTD. Price 2s. net.

"Wireless Valve Transmitters; The Design and Operation of Small Power Apparatus," by W. James. Pp. viii+271; figs. 210. London: The Wireless Press. Price 9s.

Electricity Supply Wages in Scotland.—It is officially stated that at a meeting of the Trade Union side of the Scottish District Industrial Council for the electricity supply industry the dispute between the Edinburgh Corporation and the National Union of Corporation Workers was considered, and it was decided to intimate that the Electricity Supply Industrial Council had not been consulted in any way with regard to this matter. A national application for a flat advance of 10s. per week to all grades in the electricity supply undertakings was at present under consideration. The National Union of Corporation Workers, as members of the Industrial Council, were parties to this claim and were, therefore, in the opinion of the Industrial Council, not entitled to take independent action.

British Trade Mark Applications.—The following are among the recent applications for British trade marks. Objections may be entered against any of the proposed marks within one month from the dates mentioned:—

Ripplephone. No. 449,492. Class 8. Instruments and apparatus and parts thereof for use in telegraphy and telephony.—J. W. Dungay, 1, Lulworth Street, Peckham, S.E.16. October 8th, 1924.

M.E.L. No. 451,041. Class 8. Apparatus for use in wireless telephony and telegraphy.—M.E.L., Ltd., 45-47, King's Road, Camden Town, N.W.1. October 8th, 1924.

Quasi-Arc (lettering and design). No. 448,169. Class 13. Electrodes and electrode holders, &c.—The Quasi-Arc Co., Ltd., 15, Grosvenor Gardens, London, S.W.1. October 8th, 1924.

Assistance in Shop Lighting.—Messrs. J. Lyons & Co., Ltd., the well-known caterers, have arranged with the Lighting Service Bureau of the E.L.M.A. for a series of lectures upon and demonstrations of shop lighting for the benefit of their retail distributors, of which there are a great number in and around London. Details of this matter will be supplied to anyone interested by the British Electrical Development Association, Savoy Street, W.C.2.

Award.—MESSRS. PETTERS, LTD., have been awarded a silver medal for their cold starting oil engines shown at the Reval Agricultural Exhibition.

Hospital Electric Cooking Equipment.—The General Electric Co., Ltd., has received an order for an electric cooking equipment for the Bucks County Mental Hospital at Stone, near Aylesbury. The apparatus will cater for about 1,000 persons, and will comprise a "Magnet" four-oven range, stock pots, egg boiler, boiling table, fish range, grill, baking ovens and hot-cupboards. The only non-electrical items are the existing steamers and boilers for tea, vegetables and soup, which will be steam-heated.

New Australian Company.—An Australian paper records that the Burgin Electric Co., Ltd., has been registered with a capital of £25,000 in shares of £1 each, to take over the business of manufacturers, importers, and suppliers of electrical and wireless apparatus now carried on as the Burgin Electric Co., at 352, Kent Street, Sydney.

Exhibition Note.—The Wembley Exhibition Disposals Syndicate, Ltd., has been formed to sell goods on behalf of the exhibitors. Auction sales will be held in the Civic Hall, and, as a preliminary, blue labels are being affixed to such of the exhibits as are to be disposed of.

Lighting and Power Notes.

Accrington.—Electricity in Bulk.—The Lancashire Electric Power Co. has applied to the Corporation for a temporary bulk supply, pending the erection of its new power station at Padiham.

Australia.—Western Australia.—The accounts of the Government electricity undertaking for the year ended June 30th last record a total revenue of £166,208, as compared with £137,069 in the previous year. Working expenses totalled £116,150, as against £99,718, leaving a gross profit of £50,058 (£37,351). After deducting capital charges, there was a net surplus of £429, as compared with £2,871 in 1922-23. The sales of electrical energy increased from 31,368,404 to 39,100,707 kWh.

New South Wales.—The State Government has appointed surveyors to make a study of the hydro-electric resources of Tantawanglo mountain. The survey of the northern part of the State has already been completed. At present a survey is being made on the Tantawanglo river. It is proposed to erect hydro-electric power stations for the supply of electrical energy to coastal towns in the vicinity, and eventually to merge the small schemes into larger ones, such as the Snowy river scheme.—*Industrial Australian and Mining Standard.*

Barnstaple.—Loan Sanctioned.—The Town Council has received the sanction of the Electricity Commissioners to a loan of £2,400 for coal-conveying and storage plant at the electricity works.

Barrow.—Hydro-Electric Scheme.—The Town Council has decided to proceed with the scheme for the erection of a hydro-electric power station at Backbarrow, on the River Leven, near the end of Windermere Lake, subject to sanction being received from the Electricity Commissioners. It is proposed to install three 500-kW turbo-generators, and in the event of extended drought the supply from this station would be augmented from the power station at Barrow. It is possible that electricity will be transmitted to various points at a pressure of 11,000 V.

Canterbury.—Loan.—The Town Council has applied to the Electricity Commissioners for sanction to a loan of £27,500 for extensions to the electricity works and plant.

Continental.—Sweden.—What are claimed to be the largest Francis-type twin horizontal turbines so far constructed are those which have recently been installed at the Raanaasfoss power station. The firm of J. M. Voith, of Heidenheim, Germany, and the A. B. Karlstad Mekaniskaverkstad, of Christinehamm, Norway, have each supplied three turbines rated at 13,400 h.p. each.

Norway.—The total motive power employed by Norwegian industry at present aggregates approximately 1,800,000 h.p., according to statistical information made available by the National Health Insurance Board of Norway. About 175,000 h.p. is supplied by steam, the remainder being electrical power, of which 1,600,000 h.p. is supplied by the waterfalls—*Commerce Reports.*

Coventry.—Loan.—The Town Council has applied to the Electricity Commissioners for sanction to a loan of £19,356 for mains.

Darwen.—New Plant.—The Town Council has decided to purchase a 500-kW rotary converter from Messrs. Mather and Platt for replacement purposes. Application is being made to the Electricity Commissioners for sanction and financial assistance to a scheme for the extension of the Council's electricity supply to Hoddlesden.

Heysham (Lancs.).—Loans Sanctioned.—The Electricity Committee has received sanction from the Electricity Commissioners to borrow £3,100 for mains and services for public lighting, and the Lighting Committee has received sanction to borrow £878 for the conversion of lamps from gas to electricity.

India.—Hydro-Electric Scheme.—The Kundley Power Co., Ltd., Calcutta, with a capital of 5,000,000 rupees and a loan capital of 5,000,000 rupees, has been formed to carry out an extension of the hydro-electric work of the Tata Hydro-Electric Supply Co. The company will build a main and an auxiliary dams in the Kundley Valley. A tunnel will connect the lake, which will be formed, with the power house of the Tata Hydro-Electric Supply Co. at Khopali, and an 8,000-kW generator is to be installed. The estimated cost is 10,000,000 rupees, while the proposed annual output is to be 50,000,000 kWh, all of which has already been disposed of through contract.—*Commerce Reports.*

King's Lynn.—Year's Working.—The accounts of the Corporation electricity undertaking (engineer: Mr. C. W. Jackson) for the year ended March 31st last show a total revenue of £16,625, as compared with £15,265 in the preceding year. Working expenses amounted to £8,580, as against £7,386, leaving a gross profit of £8,046 (£7,899), to which was added a balance brought forward from the previous year of £2,306, making a total of £10,352. After deducting capital charges there was a net surplus of £4,700, as compared with £2,255 in 1922-23. The sales of electrical energy amounted to 1,056,799 kWh, an increase of 100,330, and the average price obtained fell from 3.95d. to 3.70d. The maximum supply demanded rose from 812 to 873 kW.

Lewes.—Proposed Purchase of Undertaking.—The Lewes Chamber of Commerce has urged the Town Council to consider the advisability of taking over the local electricity undertaking, and the Finance and General Purposes Committee is to call a special meeting to consider the proposal.

Lincoln.—Loan.—The Town Council has received the sanction of the Electricity Commissioners to a loan of £18,765 for circulating-water inlet mains, plant, and other distribution works. Sanction to a loan for sub-station buildings is deferred for further information.

Lytham St. Annes.—Electricity Supply.—The borough electrical engineer has prepared a report on the immediate and future extensions of the electricity undertaking. An application is to be made to the Electricity Commissioners for sanction to the borrowing of £9,889 for duplicating the main interlinking feeder for the bulk supply from Blackpool, and for a new sub-station, switchgear, and other works.

New Zealand.—Electrical Development.—During the past financial year the Government has expended £812,975 on hydro-electric schemes, as compared with £472,874 in the previous year. Work on the Mangahao scheme and extensions to the Horahora and Lake Coleridge plants accounted for the bulk of the expenditure. It is anticipated that the electricity supply from Mangahao will be available during the present year.

According to the *Industrial Australian and Mining Standard*, the number of industrial consumers in Auckland is now 5,000. The increase during the present year represents, on a quarterly average, an annual gain of over 200 industrial consumers on the d.c. system within the city area, and 150 on the a.c. system in the outer circuit. The maximum peak load at the power station has been 20,000 h.p., as compared with 10,500 h.p. last year. The controlling board is now generating over 1,000,000 kWh per week.

Normanton (Yorkshire).—Loans.—The Urban District Council is applying to the Public Works Loan Board for a loan of £11,320 in connection with the local electricity undertaking, and to the Electricity Commissioners for sanction to borrow £3,770.

Northern Ireland.—Newcastle (Co. Down).—The Urban District Council has approved the local electricity supply company's scheme for lighting the streets by electricity.

Omagh (Co. Tyrone).—The Urban District Council has rejected the proposed electricity scheme on the ground of expense, but had decided to obtain the advice of an electrical expert as to the preparation of a new scheme.

Perth.—New Plant.—The Corporation power station is to be extended by the addition of a 2,000-kW turbo-generator, with a boiler and the necessary auxiliary plant, at a cost of about £10,100. The engineer has been instructed to invite offers for the supply of the plant.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

Batley.—Lighting: Flat rate, from 6½d. to 6d. per kWh; sliding scale, from 44⅔ to 33⅓ per cent. above the pre-war rate. Power, heating, and cooking: From 60 to 40 per cent. above the pre-war scale.

Tunbridge Wells.—Lighting: From 6d. to 5½d. per kWh. Power, heating, and cooking: From 1½d. to 1¼d. per kWh.

London.—*The Charing Cross Electricity Supply Co., Ltd.*—Lighting: Summer quarters, 6d. per kWh for the first 3 kWh consumed per 30-watt lamp connected (or equivalent) per quarter, and 4d. per kWh thereafter; winter quarters, 6d. per kWh for the first 7 kWh consumed per point, and 4d. per kWh for all energy in excess. Power and heating: 2d. per kWh.

Gillingham.—Lighting: Flat rate, from 6½d. to 6d. per kWh; maximum demand rate, from 10d. and 4d. to 10d. and 3½d. Power: From 4d., 3½d., and 3d. to 3½d., 3d., and 2½d. per kWh.

Oldham.—Lighting: Flat rate, 4½d. per kWh; two-rate meters, between 4 p.m. and 8 p.m., 6½d. per kWh, and between 8 p.m. and 4 p.m., 3d. per kWh. Heating and cooking: 1½d. per kWh. Power: First 1,000 kWh per quarter, 1½d. per kWh; beyond, 1¼d. Maximum demand system: £3 12s. 6d. per kW per annum, plus 0.75d. per kWh (demands of 25 h.p. and over, plus 0.6d. per kWh).

Whitehaven.—Lighting: Flat rate, from 6½d. to 6d. per kWh.

Reigate.—Loan.—The Town Council has applied to the Electricity Commissioners for sanction to the borrowing of £2,000 for mains and services.

Stockton-on-Tees.—ELECTRICITY SUPPLY.—The Corporation has put into operation its electrical extension to Hartburn. The Hartburn sub-station will serve as a supply depôt for a large foundry, and marks the completion of the first step in the extension of the supply to Eaglescliffe.

Stonehaven.—ELECTRICITY SUPPLY.—The Town Council has adopted the proposed scheme for electric lighting, the power to be provided by Aberdeen. Overhead l.p. transmission lines will be erected, and a sub-station is to be built in the town.

Tonbridge.—LOAN.—The Urban District Council has applied to the Electricity Commissioners for sanction to the borrowing of £3,500 for mains.

Wallasey.—POWER STATION EXTENSIONS.—The Corporation is spending over £100,000 in modernising and remodelling its power station. The new set now being installed at a cost of £24,000 will increase the capacity of the station from 6,000 to 11,000 kW, and the three other sets will give the station a stand-by of a further 5,000 kW in case of breakdown. New switchgear is being installed at a cost of £13,000. Improvements to the boiler house are in hand and coal-conveying plant is being installed at a cost of £37,000. It is anticipated that the work will be completed before the end of the year.

Tramway and Railway Notes.

Blackpool.—PARLIAMENTARY BILL.—A Parliamentary Bill is being promoted by the Corporation providing for an extension of the period allowed for the construction of new tramways authorised by the Blackpool Improvement Act, 1917, and a revival of powers contained in the 1919 Act for the construction of new tramways.

Continental.—AUSTRIA.—According to *Commerce Reports*, further progress has been made with the electrification of the railways by the conversion of 107 km. of the Attnang-Stainach-Irdning line. Electrical energy is furnished by the "Steeg" power station of the Austrian firm of Storn & Hafferl, Ltd., where two 5,000-h.p. turbines have been installed, and the single-phase 5,000-V current generated is stepped up to 15,000 V, at which pressure it is used directly by the 1,000-h.p. locomotives in use.

ESTHONIA.—The first electric railway in Esthonia was recently opened by the Minister of Communications. The length of the line is 11.5 km. connecting Tallinn (Reval) and Paaskula with two intermediary stations at Jarve and Nomme. Electrical energy is supplied from a power station situated about 60 km. from Reval on the Ellamaa peat bogs. The total cost of the railway was 36 million Esthonian marks.—*Reuter* (Reval).

Darlington.—PROPOSED RAILLESS CARS.—The Town Council has adopted a recommendation of the Tramways Committee that Parliamentary powers be obtained to substitute railless cars for the present tramway system.

Doncaster.—TRACK RECONSTRUCTION.—The Tramways Department has received sanction from the Ministry of Transport to a scheme for doubling and altering the tramway track at St. Sepulchre Gate.

Glasgow.—SUBWAY RAILWAY IMPROVEMENTS.—The subway railway, which the Corporation acquired about two years ago at the price of £385,000, and which has since been carried on as part of the municipality's tramway undertaking, is shortly to be modernised and brought up to date. If the Corporation succeeds in obtaining the necessary Parliamentary powers, it is proposed to spend a sum of £1,000,000 on improvements. The scheme provides for two siding loops for the accommodation of cars not required during slack periods, the improvement of the entrances and exits to underground stations, the provision of mechanical passenger lift arrangements, and the conversion of the running of the cars from cable to electricity, and increasing the speed between stations from 12 to about 30 miles an hour. This, of course, would also necessitate the provision of additional cars.— *Financial Times.*

London. — NEW TUBE STATION. — The new tube station at Burnt Oak on the recently-opened Hendon and Edgware tube extension is to be opened for traffic on October 27th.

Rochdale.—NEW CARS.—The Minister of Transport has sanctioned the borrowing by the Corporation of £11,000 for the purchase of six new tramcars, and has also approved the substitution of double for the single track in Milnrow Road, between Walker Street and Moss Street.

South Africa.—RAILWAY ELECTRIFICATION.—In a report recently issued by the Railways and Harbours Board, it is announced that considerable progress has been made in connection with the electrification of the railway between Glencoe and Pietermaritzburg, and a portion of the electrified section will be opened for traffic towards the end of 1924, the whole scheme being completed about the middle of the following year. Referring to the electrification of the Cape Town-Simon's Town, the Monument-Sea Point, and Monument Docks lines, the report states that the estimated capital expenditure is £759,375.

Telegraph and Telephone Notes.

Canada.—TELEPHONE SERVICE.—At the recent telephone convention in Winnipeg, it was stated that there were installed in Canada 1,046,000 telephones, or somewhat more than one telephone for each ten persons of the population. These figures place Canada in the second place among the countries of the world in the use of telephones in proportion to population. The Canadian telephone business represents an investment of $187,000,000 and gives employment to 21,000 persons, excluding large numbers of manufacturing concerns supplying material for the development and maintenance of the service.

China.—RADIO TELEPHONY.—A German firm is asking permission of the Ministry of Communications to install radio telephone services between Peking and Tientsin and Tientsin and Shanghai.

TELEPHONE FACILITIES.—The Peking Telephone Administration has decided to open a branch exchange for the southern section of the city, to be known as the South Branch Exchange. One thousand five hundred new telephone numbers will be installed in the new exchange.

MANCHURIAN RADIO STATIONS.—Manchuria has at present 17 radio stations. The largest are at Mukden, Harbin, Changchun, and Hulutao.—*Chinese Economic Bulletin.*

Denmark.—TELEPHONE COMMUNICATION.—Negotiations are in progress between the British and Danish authorities for the establishment of telephonic communication between the two countries. It is expected that connection will be established *via* Holland and, according to *The Times*, this is part of the scheme for a Northern Europe telephone service. The new Anglo-Dutch cable provides 12 circuits, and it is hoped eventually to provide communication with all parts of Northern Europe. Only one circuit is now in use, but before the end of the year it is expected that the whole of the 12 circuits will be available for calls to and from Germany and Scandinavia.

Japan. — TELEPHONE RECONSTRUCTION IN TOKIO.—Out of a total of 84,000 telephone subscribers in Tokio there are now in service 28,000 telephones. This number will be increased to 64,000 when the Asakusa, Ginza, Hamacho, and Sumida exchanges are restored. Of the 18 exchanges in the capital 14 were destroyed by fire. Half the new system is to consist of automatic equipment, for which 50,000 instruments have been ordered from England. The entire system eventually is to be automatic, and it will be extended to Yokohama next year. There were 10,000 telephones in the port city before the earthquake, and 2,500 are operating now.—*Far Eastern Review.*

Spain.—TELEPHONE CONCESSION.—Official confirmation has been given to the plan to permit the Compania Telefonica Nacional Espanola to purchase and operate under one management all Spanish telephone systems. American interests are represented on the board of directors, and a feature of the concession is the provision for several directors to be appointed by the Government with special authority regarding rates and other matters affecting public interest. Previously, says *Commerce Reports*, the American interests participating had, by purchase of stocks, secured control of about 40,000 of the total 95,000 telephones in Spain. It also had purchased an interest in, or had options on, other systems comprising 10,000 more telephones. All these holdings have been transferred to the new company in exchange for stock. Rehabilitation work planned for the immediate future includes the installation of automatic exchanges and underground cable systems in 17 principal cities, and the betterment of the existing toll service. The American interests will assume technical direction and purchase equipment, though the new company has agreed to make purchases in Spain unless foreign materials can be obtained 10 per cent. cheaper.

Radio Notes.

Germany.—BROADCASTING CONGRESS.—At the first German broadcasting congress in Berlin it was stated that there are now a quarter of a million receiving sets in use in Germany, of which 120,000 are in Berlin, with a daily increase of 2,000. Dr. Von Bredow, of the Postal Ministry, said that a million Germans now listened every day, and the total would soon be doubled.—*Evening News.*

Long-distance Reception.—AMATEUR'S CLAIM.—An English amateur, Mr. R. W. Galpin, of Herne Bay, claims to have received the signals of an Australian amateur—which would be the first time it has ever been done. He is seeking to secure confirmation from Australia. The receiving set used was one of two valves made by himself. Mr. Galpin told a *Daily Mail* reporter that he picked up the general call to all stations CQ and then the station call A2 ADJ. "The signals were weak," he said, "but despite interference from atmospherics were easily readable."

South Africa.—Capetown Station.—Broadcasting, which is under the direction of the Cape Peninsula Publicity Association, commenced on September 15th. The installation is a 6-kW outfit supplied by the Marconi Co., similar to the one in use in London.

United States.—Need of Regulations.—In an address to the Third Convention of "Radiomen" on October 8th, President Coolidge quoted Mr. Hoover's recent declaration that the Government should retain control over the ether, and that the rights of the people ought to be protected. It naturally followed, continued the President, that rules and regulations were necessary to prevent confusion and improve the opportunities offered by the science of "wireless." He urged that measures should be taken to guard against the admission of any item for broadcasting that contained malice or slander, and said that with governmental supervision there would be "the widest freedom."—*Reuter* (Washington).

Proposed New Station.—The vice-president of the Radio Corporation has announced that it is ready to erect a super-power broadcasting station near New York, if no interfering regulations are adopted.—*Financial Times.*

Radio "World's Fair."—Awards in the "New Inventions Division" were made to Mr. E. T. Flewelling for the "originality and perfection" of his new circuit; Mr. H. Frost, for successfully adapting bakelite to the manufacture of loud-speaker horns; Mr. B. Johnson, for his "radio ear" and "loud-speaking crystal set" inventions; Mrs. Frank L. Savage, for her "portable antenna" invention; and to Messrs. P. McGinnis and J. F. Maher, for their "filter tuner" invention, which they have presented to the radio enthusiasts of the world. A silver loving-cup was also awarded to Mr. Edgar James, chairman, by the directors of the Fair, as a token of appreciation for valuable services rendered to the various departments of the exposition.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Australia.—Sydney.—January 28th. N.S.W. Government Railways. Two steam turbine-driven boiler feed pumps and two motor-driven ditto. Chief Electrical Engineer, 61, Hunter Street, Sydney.—*Industrial Australian and Mining Standard.*

Municipal Council. November 3rd. Ten h.p. switchboards and 10 l.p. switchboards.—*Reuter's Trade Service* (Melbourne).

Melbourne.—November 24th. Electricity Commission of Victoria. 5 miles .15 sq. in. 3-core paper insulated lead-covered armoured 22,000-V power cable.

Five miles .007 sq. in. 3-core 2 pair paper insulated lead-covered armoured pilot cable, joint boxes and trifurcating boxes.—*Reuter's Trade Service* (Melbourne).

Ayrshire.—Education Authority. Electric lighting installation at Maybole Academy. Mr. W. Reid, master of works, 14, Wellington Square, Ayr.

Belgium.—October 29th. The Belgian Post and Telegraph authorities at La Salle Madeleine, Brussels, are inviting tenders for the supply and laying of a quantity of telephone cable, with accessories, at Malines, Wavre, Brasschaet, Dolhain, Bruges, Audenarde, and Mouscron. Particulars (Cahier des Charges Special No. 3-61) for 7½ fr.

Carlisle.—October 27th. Committee of Cumberland Infirmary. Heating and electric lighting in connection with the new out-patients' department at the Infirmary. John Burnet, Son & Dick, architects, 239, St. Vincent Street, Glasgow.

October 31st. Board of Guardians. Wiring for electric lighting and power at the Fusehill Institution. (See this issue.)

Croydon. — Electricity Department. Railway siding (400 ft. double track), weighbridge, wagon tippler, and coal-conveying plant. (See this issue.)

Christchurch (Hants.).—October 20th. Board of Guardians. Electric wiring in connection with extensions to laundry equipment and machinery. Mr. P. C. Ford, clerk, Fairmile House, Christchurch.

Dundee.—October 20th. Electricity Department. Four 200-kVA transformers, two sets of e.h.p. sub-station switchgear, and e.h.p. and l.p. cable. (October 3rd.)

Town Council. Electric light installation and addition to nurses' dormitory at King's Cross Hospital. Mr. G. Baxter, city engineer.

Egypt.—Cairo.—November 1st. Director-General, State Domains Administration (Commercial Service), Savoy House, Cairo. Four semi-Diesel engines and four centrifugal pumps.

Khartoum.—October 30th. Inspector-General of Irrigation. Electric lighting set, including engine, dynamo, fittings, fans, lamps, &c., and electric bell system for the Egyptian Irrigation Service steamer *Kassala*. Specifications from the Inspector-General of Irrigation, Khartoum, Sudan.

Edinburgh.—October 27th. Education Authority. Electrician's work at St. John's R.C. School, Portobello. Messrs. Reid & Forbes, architects, 7, Ainslie Place, Edinburgh.

Hailsham.—October 29th. Board of Guardians. Electric lighting installation at the Institution, Hellingly. (October 10th.)

India.—October 24th. India Stores Department, Belvedere Road, S.W. Diesel-electric generator set. (October 3rd.)

November 4th. Testing motor-alternator sets (22.5 kVA and 10 kVA, 3-phase alternators), complete with controlling switchgear, portable transformers, &c. (See this issue.)

Bombay, Baroda, and Central India Railway Co.—December 15th. Electrification of Bombay suburban lines. Electrical equipment of coaches. (October 10th.)

London.—H.M. Office of Works.—October 22nd. Building manholes and the supply and laying of cables at the National Physical Laboratory, Teddington. (October 3rd.)

London County Council.—October 27th. H.p. electric cables and withdrawing, repairing, and relaying existing l.p. cables. (October 10th.)

Islington.—November 5th. Electricity Department. H.p. switchgear. (October 10th.)

Paddington.—November 21st. G.W. Railway Stores for 12 months, including telegraph instruments, electrical apparatus, wires and cables, &c. (See this issue.)

Luxemburg.—November 10th. The Syndicat des Communes pour le Construction et l'Exploitation de Tramways Intercommunaux dans le Canton d'Esch, at 25, Rue Larges, Esch-sur-Alzette, Luxemburg, is inviting tenders for the supply and erection of about 50 kilometres (31¼ miles) of overhead tramway conductors and for the establishment and equipment of three transformer sub-stations.

Maidstone.—Electricity Works. Water-softening plant; coal unloading plant, consisting of electric jib crane, automatic weigher, and splash hopper. (See this issue.)

Shrewsbury.—October 29th. Atcham Board of Guardians. Electric lighting plant and X-ray apparatus, Berrington Hospital, Cross Houses. Messrs. Henry Lea & Son, consulting engineers, 1, Newhall Street, Birmingham (returnable deposit of £3 3s.).

Skipton.—October 21st. Electricity Department. Motor generator. (October 10th.)

South Africa. — Johannesburg. — November 12th. Municipal Council. One 750-kW rotary converter.*

Bloemfontein.—December 1st. Municipal Council. H. and l.p. switchgear, transformers, auxiliary motor switches, &c.; material for interior and exterior power and lighting circuits in the new power station, and boiler-house equipment, piping, pumps, &c.*

Thorpe (Norwich).—November 4th. St. Andrew's Hospital. Lagging of steam pipes and vessels. (October 10th.)

Torquay.—October 20th. Electricity Department. One 3,000-kW turbo-alternator and surface condensing plant. (October 10th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Belgium.—Keen international competition was experienced in Brussels on October 1st for a number of Belgian Post and Telegraph cable and wire contracts, tenders being received from Belgian, French, Danish, Czecho-Slovakian, and British concerns. The lowest tenders were as follows:—The Norsdiske Kabel og Traatfabricker, Copenhagen: 100 kilometres of waxed cotton-covered wire, 40 kilometres of lead-covered cable with cotton-covered enamelled conductors, 600 metres of rubber- or paper-insulated cable with bare lead casing, and 60 kilometres of lead-covered cable. La Société Centrale d'Electricité et de Construction, Brussels: 500 kilometres of twisted wire and 6 kilometres of lead-covered telephone cable. H. Foulds (London): 975 kilometres of corded wire. La Société des Cableries et Corderies du Hainaut, of Dour: 1,000 kilometres of compound wire and 1,600 metres armoured lead-sheathed paper-insulated cable. La Société des Ateliers de Constructions Electriques de Charleroi: 2,316 metres of bare lead-sheathed paper-insulated cable, and 950 metres of similar cable, but armoured; and La Société Omnium Electrique, of Dison: 30 kilometres of flexible wire.

Makers in no fewer than eight countries—Belgium, Holland, Great Britain (the British Insulated & Helsby Cables, Ltd.), Denmark, France, Czecho-Slovakia, Germany, and Italy—competed last week for a small contract of three kilometres of l.p. armoured cable for the municipal authorities of Schaerbeek. The quotations ranged from 25,500 to 61,000 fr., the lowest offer being that of the Société des Ateliers des Constructions Electriques de Charleroi.

(Continued on page 584.)

Wm. Bradley Woodhouse, M.Inst.C.E., M.I.E.E., M.I.M.E.,

President of the Institution of Electrical Engineers, Session 1924-25.

On the first of this month Mr. W. B. Woodhouse assumed the high office of President of the Institution of Electrical Engineers; already a busy man, he will find that his new duties, many and varied as they are, will deprive him of what little leisure he previously possessed, but that he will discharge them with the efficiency and self-sacrifice that are expected of the President no one who knows him will question, and his long service on the Council and on the committee of the North Midland Centre has rendered him fully conversant with the work.

Mr. Woodhouse, who is the youngest son of Mr. Thomas Woodhouse, of Dalmuir, was born in London in 1873, and received his electrical training at Finsbury Technical College; after a spell of mining installation work in the Midlands and South Wales, he served an engineering apprenticeship with the Silvertown Co., and engaged in further study at University College, London. In 1895 he became a lecturer on mechanism and mathematics at Finsbury, under Prof. Dalby, leaving this post four years later to join the staff of the Newcastle - on - Tyne Electric Supply Co. under Mr. Charles Merz, and in 1903 he was appointed engineer and manager of the Yorkshire Electric Power Co., which position he still holds, dealing with an area of 1,800 square miles.

William Bradley Woodhouse, President I.E.E.

Great changes have taken place in the 21 years which have elapsed since that date; in those early days a power company was a novel institution, and it had to fight for existence against a multitude of difficulties — political, financial, and domestic (for the difficulties were not all outside the power station). The public had to be educated to the benefits to be derived from the use of electricity. Fortunately public opinion has changed with the times, and nowadays the importance of an adequate supply of electric power in industrial areas is fully realised, even by Governments.

Mr. Woodhouse struck out from the first on bold lines which are to-day sound practice: he employed three-phase four-wire distribution at 400 volts, with an intermediate distribution pressure of 2,000 volts, at 50 cycles; in 1904 he adopted the practice of basing the maximum demand charges on kilovolt-amperes, which is now generally followed, and in the following year he introduced a coal clause into his agreements. Fuel economy has occupied his attention for many years. In 1913 he designed and set in operation a generating station using surplus coke-oven gas as fuel, which has since been considerably extended, and he was an original member of the British Association Fuel Economy Committee; he has also been associated with the development of coal carbonisation processes, at both high and low temperature, in conjunction with power supply.

Being domiciled in a colliery district, Mr. Woodhouse has been closely connected with the use of electricity in mines, and is a member of the Institution of Mining Engineers; as electrical adviser to various collieries, he has been responsible for the installation of many electrical winders and the complete electrification of colliery power plants. His work in connection with overhead lines is well-known, and he was one of the first to press for compulsory wayleaves.

Mr. Woodhouse takes a broad view of the duties of an engineer, and plays an active part in the development of electricity supply. Last year he was president of the Electrical Development Association, and he was a member of a number of special committees dealing with such matters during the war, acting also as electrical adviser to the Coal Controller for Yorkshire; as a member of Council of the Association of Power Companies, he gave evidence before Sir A. Williamson's Electric Power Supply Committee, whose report led to the passing of the Electricity (Supply) Act of 1919.

Amongst his other activities may be mentioned his service (twice) as chairman of a Local Centre, and as member of Council and Vice-President in turn, he has sat on the Council of the Institution for eight years, during which time he has served on special committees and has represented the Council at various international conferences. He is a member of the Sectional Electrical Committee of the British Engineering Standards Association, and chairman of the Committee responsible for specifications for overhead line materials; he is also chairman of a Committee of the Research Association dealing with similar matters. He was one of the original members of the National Industrial Council for the Electricity Supply Industry and the National Joint Board. He is a member of the Institution of Civil Engineers, and has contributed papers to the proceedings of a number of societies, mainly on problems connected with electricity supply.

Of charming personality and unfailing courtesy, the new President cannot fail to secure the support of the members of the Institution and to rise still higher in their esteem during the session which is now commencing, and we offer him our hearty good wishes for the success of his year of office.

In view of the interest which is being displayed just now by more than one political party in the question of electricity supply, it is fortunate that an engineer so experienced in this problem is at the head of the industry.

F

Some of the Exhibits at Wembley.

Mr. Bertram Thomas.

(Stand No. 9, Avenue 8, Bays 23 and 24).

Amongst the products of Mr. Bertram Thomas exhibited at the British Empire Exhibition, switchgear and control apparatus of somewhat unusual design is on view which is worthy of more than a cursory examination. Minute inspection is not necessary to reveal its robust simplicity, and a feature of the lighting and traction switchboards is the mechanical interlocking system which prevents errors in switching operations.

Most of the gear displayed has been constructed for heavy duty, yet its dimensions are such as to suggest a substantial saving of space necessary for its accommodation. For instance, the backless type board illustrated in fig. 112, which has been designed for restricted sites, complies with the Board of Trade requirements and yet does not necessitate the provision of a passageway behind it. The panels can be bolted right up against a wall and all the instruments, busbars, connections, &c., are attached from the front, the panels themselves being mounted in the same fashion. The main cables are brought to their terminals through the connecting tube shown in the middle of the board. Where space is limited this style of construction is of real advantage. The circuit breakers shown are of the solenoid-operated pattern, and the particular panels illustrated were made for use in a remotely-controlled sub-station.

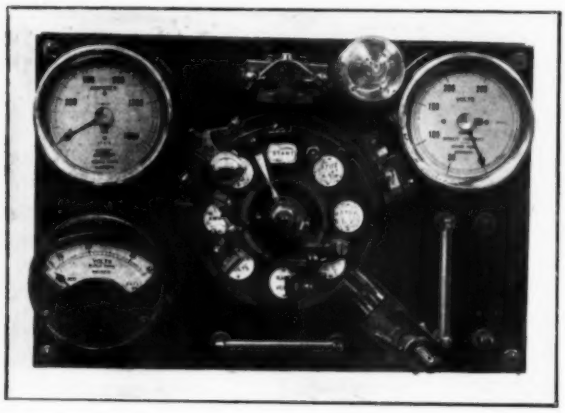


Fig. 111.—Remote Control Panel.

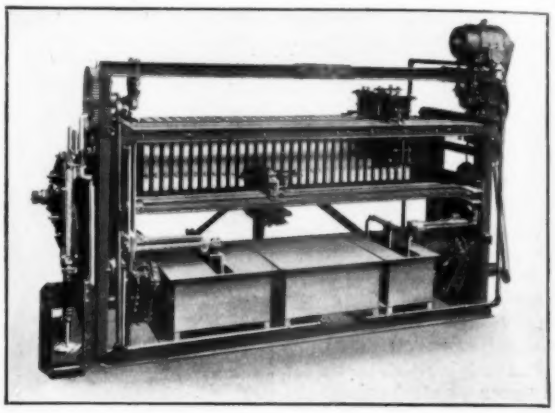


Fig. 114.—Battery End-cell Regulator.

In this connection the remote control gear for sub-station plant is probably the most interesting item on the stand. Remote control is considered by many engineers to possess advantages over the full automatic system—amongst them being greatly reduced first cost—inasmuch as it makes superintended management of each sub-station possible from a central position, such as a main generating station. The gear is exhibited in conjunction with a Mather & Platt rotary converter and a Ferranti transformer. Each machine requires one pair of pilot wires only for its control, which are brought to a small panel, fig. 111, on which are mounted the controller in the centre and indicating instruments by means of which each machine can be started, regulated, and stopped entirely or merely removed from the d.c. busbars at will. The output of each machine can be read on the meters on the control panel, while load such as occurs in industrial districts can be anticipated and the necessary number of converters started and connected to the d.c. busbars a few minutes before the load materialises. Fig. 113 shows the machine panel which is mounted in the sub-station and full protection can be provided, including polarity, excess temperature, overspeed, &c., devices, the synchronising operations being, of course, automatic. The control panels

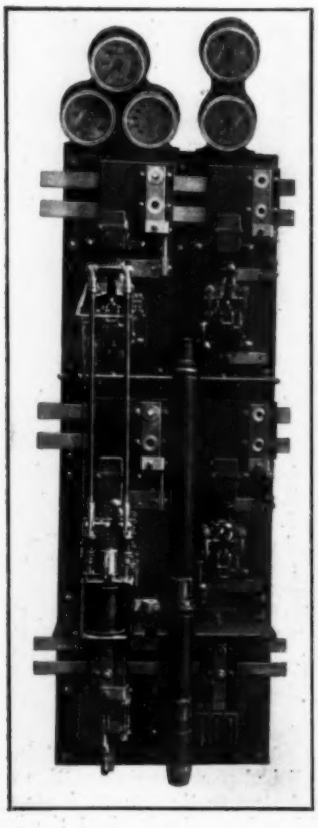


Fig. 112.—"Backless" Type Switchboard.

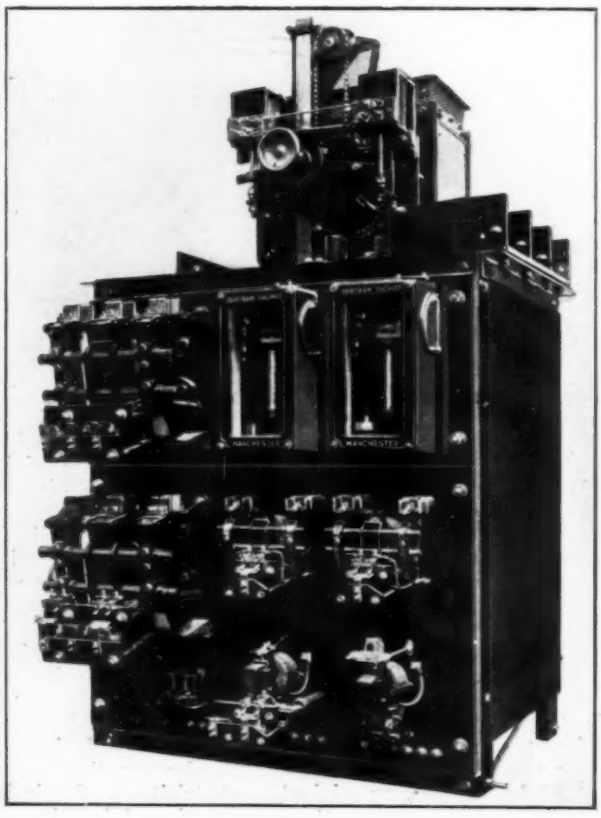


Fig. 113.—Sub-station Contactor, &c., Gear.

are quite small, only 18 by 12 in., so that a group to control four machines only covers an area 4 ft. high by 18 in. wide. In the event of a shut down, the load might frequently be too great to allow the machines to come in one at a time; arrangements have accordingly been made whereby it is possible to start each machine individually and then to "fire" them all on to the busbars together simultaneously by the operation of a single group switch.

Another exhibit that merits attention is the large battery end-cell regulator shown in fig. 114. It has a capacity of 10,000 amperes, is motor driven, and worked either automatically by means of voltage control, or by a controller which can be fixed at a distance from the switch. Cells can be cut in or out of circuit at will during the heaviest loads without damage to the main contacts, while such switches are of great value with large batteries which may have to tide over a shut-down of plant in a generating station. The end cells enable the voltage to be maintained normal throughout the discharge period of the battery, which is not possible with a boosted system that limits the discharge of the battery to the capacity of the booster, and this is usually only about one-third

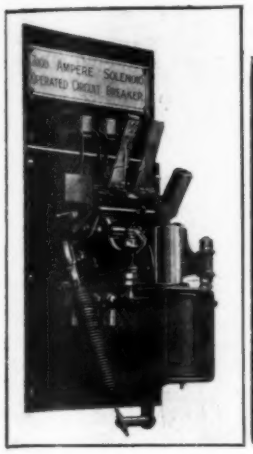


Fig. 115.—A 7,000-A Circuit Breaker.

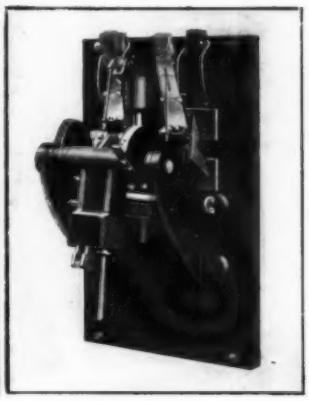


Fig. 116.—Gravity-operated Change-over Switch.

of the full discharge rate of the battery. The regulator is fitted with a lead-saving device and jockey-cell switch, by means of which the number of connections to the cells is reduced by one half for a given number of steps. This is a great saving of expense when large currents are dealt with. The controller indicates the number of cells in use at any time.

The booster-battery change-over switch illustrated in fig. 116 is gravity operated and designed for the purpose of cutting out the booster and putting the battery direct on the line when required. The electricity supply is maintained through the arc at the carbon contacts at the moment of opening, while the switch can be worked from a distance by a push button or automatically from the machine. Such switches have been made for a working load of 15,000 amperes for Manchester Corporation.

The solenoid-operated circuit breaker shown in fig. 115 is constructed to carry 7,000 amperes as a regular load. The mechanism is exceptionally substantial and the contact brush is composed of a number of narrow brushes of hard-drawn copper, each making independent contact with copper plates fastened to the slate base. The powerful solenoid is energised only while it is operating and various forms of trip gear, over-

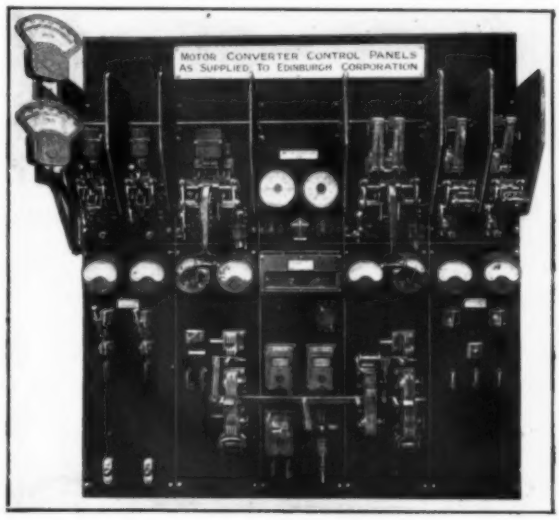


Fig. 117.—Switchboard as Installed at Edinburgh.

load and reverse relays, &c., can be fitted. The break is made on carbon contacts, whilst the shock at opening is taken by Ferodo brakes..

The board illustrated in fig. 117 is typical of panels forming part of a large order for the Edinburgh Corporation, where such apparatus was fitted in seven sub-stations. The switchgear shown is arranged to control one motor converter and to supply power for either lighting or traction feeders, interlocks being provided to limit the supply to either lighting or traction as required. The feeder panels are fitted with circuit breakers with a carbon break for lighting and with a magnetic blow-out for traction, while all switches and circuit breakers have multiple-strip back connections.

The Rheostatic Co., Ltd.

(Stand No. 1, Avenues 8 and 9, Bay 5.)

The product exhibited consists of an entirely new departure in grid resistances, the principal feature of the design being

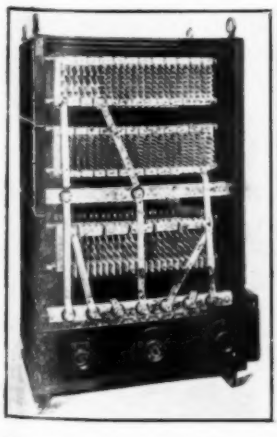


Fig. 118.—A "Rheostatic" Haulage Resistance.

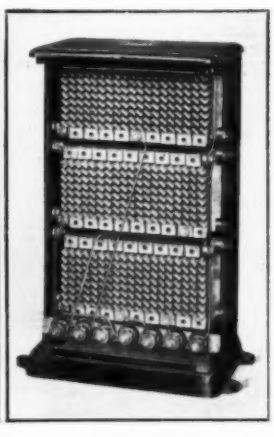


Fig. 119.—A "Rheostatic" Tramcar Resistance.

that the grids are so rigid that they can only be forced into contact with one another by deliberate intent, and it is claimed that the natural period of vibration of the grids is so high as to be beyond the range of vibration of any mechanical structure on which resistances are used, and so it is impossible for adjacent grids to vibrate into contact. An unmounted resistance bank of grids is shown on a stand so that examination can be easily made. Apart from the great rigidity, the design provides for the elimination of an old defect in grid resistances, namely, defective joints between grids, by the welding of the adjacent grids in such a manner that a flat

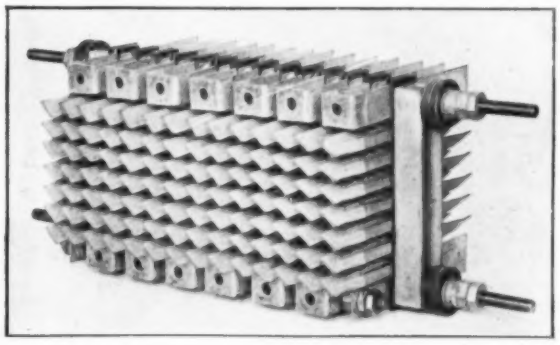


Fig. 120.—An Unmounted "Rheostatic" Resistance Bank.

surface is left at each weld for the purpose of making tappings at any desired point. The whole of the components and grids are made from rolled material, and the units are therefore unbreakable, and they are also zinc covered to prevent corrosion, the process used being sherardising. All insulation for standard designs is of mica or micanite.

Complete resistances are shown of various sizes in a variety of mountings, and it is worthy of note that all end plates, &c., are in the form of steel pressings of ample strength. The principal feature of the finished mounted resistances is that every standard design incorporates a terminal bar carrying a complete set of terminals to which the tappings from the grids are brought down, thus obviating any necessity of running controller cables amongst the grids themselves. The examples exhibited include a four-tier, 150-h.p., 500-V haulage resistance, giving continuous creeping speed (fig. 118); an unmounted bank of grids (fig. 120); and a platform type tramcar series-parallel resistance for two 30-h.p. motors (fig. 119).

Mr. George Ellison.

(Stand No. 48, Avenue 11, Bays 20–22.

The firm of George Ellison has a very attractive stand equipped with a wide range of switchgear suitable for sub-station service, and for the control of electrically-driven machinery, including circuit-breakers, motor starters and controllers, connectors, &c. The switchgear is simple in design, of robust construction, and well finished.

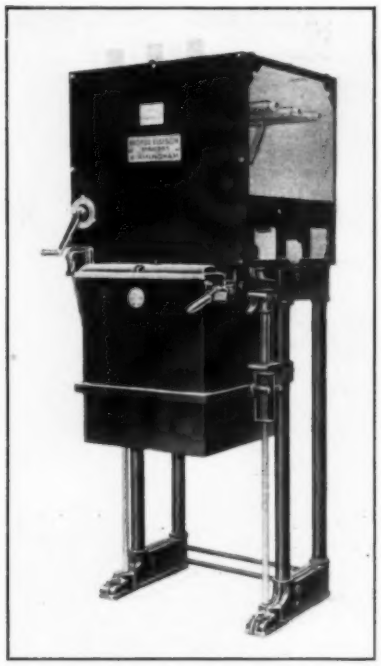


Fig. 121.—Ellison 6,600-V Oil-Breaker.

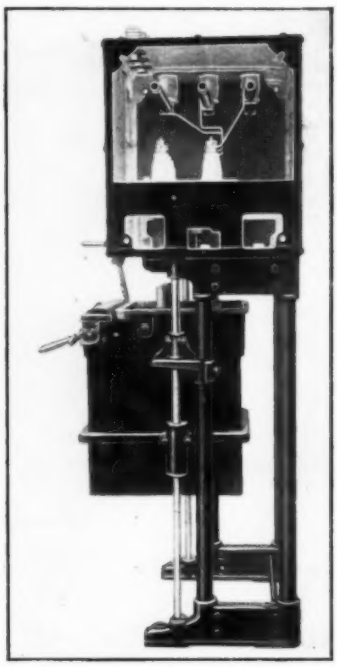


Fig. 122.—End View, with Breaker Isolated.

One of the latest designs is a hand-operated 6,600-volt 250-ampere "drop-down" distribution unit (figs. 121 & 122), designed to occupy a minimum of floor-space in a sub-station. The gear is provided with a complete system of interlocks; the circuit-breaker is lowered for inspection, far enough to withdraw the sockets from the isolating plugs, and further motion lowers the oil tank only, the lowering gear being interlocked with the circuit-breaker, while the live contacts are covered when the breaker is down. The overload coils are series wound and immersed in the oil. The contacts are self-aligning, and the insulation is of porcelain and reinforced bakelite. The busbars are copper tubes, encased in bakelite and housed in a closed chamber. Any number of these units can be combined to form a switchboard.

Unit switchgear of the draw-out type is also shown, for collieries and factories, totally enclosed in steel. The circuit-breakers are completely interchangeable, so that a spare one can be substituted at once for one out of commission. Special attention is drawn to the non-chattering no-volt coil, the strength of the no-volt release spring, and the ease with which the switch can be tripped. The contacts are interleaved, and are deeply submerged under oil. Five sizes are made, all of which can be built up together on the unit system. The busbar chambers are of boiler plate, and the stands are of the tubular type. Complete interlocking is provided. These units are made for currents up to 1,200 amperes and pressures up to 660 volts.

Amongst the many other items may be mentioned a gate-end box on a skid frame, fitted with an air-break magnetic blow-out circuit breaker enclosed in a heavy explosion-proof cast-iron box with a hinged cover. The plug and socket connector for the trailing cable is interlocked so that the cable cannot be disconnected when the breaker is closed, nor can the fixed contacts be uncovered when the cable is not connected to the breaker.

Messrs. Whipp & Bourne, Ltd.

(Avenue 15, Bays 6 and 7.)

This exhibit includes several examples of the company's "Reliance" automatic loose-handle air-break circuit breakers. These range from the largest standard size—10,000 A single-pole, to the smallest "midget" type for currents up to 50 A. Fig. 123 shows the latter compared with a 6,000-A "Reliance" breaker. Both carbon-break and magnetic blow-out types are shown, either for hand or electrical operation, in open-type for switchboard mounting, semi-protected traction and totally-enclosed types for industrial purposes, and flameproof types for mining use. Several of these circuit breakers are arranged for operation by means of low-power windings for demonstration purposes. Fig. 124 shows a carbon-break, 400-A, single-pole circuit breaker, and fig. 125 is a typical magnetic blowout 300-A single-pole overload and no-voltage circuit breaker.

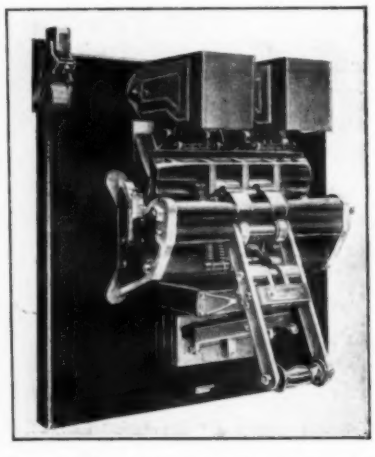


Fig. 123.—A Whipp & Bourne "Reliance" Circuit Breaker.

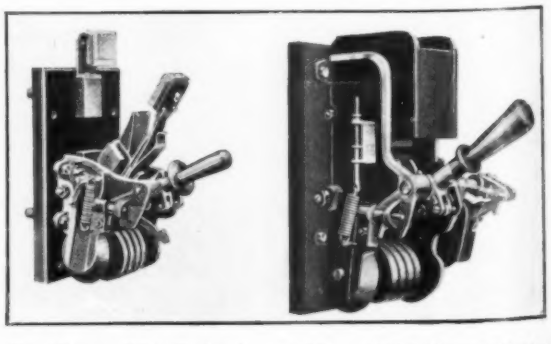


Fig. 124.—A 400-A Single-pole Carbon-break Circuit Breaker.

Fig. 125.—A 300-A Magnetic Blow-out Circuit Breaker.

A complete generator and one feeder panel taken from a marine main switchboard similar to those which the firm has designed and built for the 16 vessels laid down by the Cunard and Anchor Line Steamship Co. under its post-war ship-building programme are shown. The generator circuit breakers on this switchboard are arranged for hand or electrical operation, and they are also interlocked to prevent mis-operation. Those on the feeder panels are hand-operated and tandem-coupled, an arrangement which keeps each pole isolated on its particular panel throughout the switchboard.

High-pressure steel-clad cubicle switchgear is also shown, this being represented by a 6,600-V draw-out type truck cubicle fitted with change-over ring main switches in separate chambers. The truck itself embodies a novel design of self-aligning grip contacts. The arrangement of these coupling contacts permits of the interconnections between them and the oil switch being made without any crossing of the different phase connections, resulting in a very simplified construction. A unit type 6,600-V cubicle, as supplied for use on consumers' supply service feeders, is also shown. This apparatus is complete with isolating and oil switches in separate chambers, the incoming trifurcating box being fitted outside the cubicle and the outgoing cable box inside the oil switch chamber. Inspection doors are provided, which can be interlocked as desired. A two-panel ironclad oil-break circuit breaker of the unit type for use in industrial establishments is shown. Each unit is self-contained, and consists of separate bus-bar chambers with isolating switches to couple to the oil breaker. The switches are interlocked. They can be fitted with a maximum of four automatic release features, *i.e.*, three overloads and one no-voltage and/or shunt trip releases. The cases are of sheet steel construction with cast bases and covers, supported by cast standards, forming a neat and robust construction.

In addition to the above, many examples of the firm's manufactures in switches, fuses, fuse-boards, oil-break circuit breakers, motor starters, rheostats, control pedestals for alternators, &c., are shown, covering, in a fairly comprehensive manner, its switchgear products in most general demand.

Messrs. Thos. Firth & Sons, Ltd.

(*Stand No.* 8, *Avenues* 7 *and* 8, *Bays* 21 *and* 22.)

A selection of many different types of turbine blading appears on this stand, and a particularly interesting exhibit is an actual section removed from a 2,000-kW Westinghouse turbine, steam pressure 200 lb., superheat 200 deg. F. This section shows 12 blades. Three of these are of 5 per cent. nickel steel, which were inserted on June 11th, 1920, the actual hours run being 12,809; three are of Firth stainless steel, which were also inserted on June 11th, 1920; and six are of 5 per cent. nickel steel, which were inserted in August, 1916, and have actually run for 29,989 hours. The nickel steel blades which were inserted in 1920 show very marked signs of erosion, being very rough and pitted, and the edges show distinct signs of fraying. The nickel steel blades inserted in 1916 are worn out, the edges are frayed, and erosion has caused holes to appear in the actual blades. The stainless steel blades, on the other hand, are as bright and as unaffected as on the day of their insertion. The edges retain their initial sharpness, and no signs of wear are apparent anywhere. A valve and seat in stainless steel and similar parts in brass are shown side by side, as they were used in the steam traps on water calorifier exhausts. The former, after 17 months' continuous working, show no signs of corrosion or erosion, and practically no wear. The brass valves and seats seldom have a life of more than nine months, by which time the edges of the seat and the valve stem under the head become eaten away. A pump rod of stainless steel which has been in use in an ammoniacal liquor pump for about nine months is shown. The life of the common steel rods usually employed has never been more than six months, and the wear is several times greater.

A shaft and impeller, as fitted to the centrifugal circulating pump of a 2,000-kW Westinghouse turbine, form another exhibit. The speed of the pump shaft is 1,440 r.p.m. The glands are packed with common grease packing with water seal. With stainless steel shafts the life of the packing is doubled, and it needs much less attention.

Other stainless steel manufactures on view are:—A valve and seat of a main steam stop valve of a "Weir" boiler feed pump; the impeller shaft of a centrifugal pump; an air-pump piston rod; a chain-grate stoker spindle for Babcock and Wilcox boilers; a boiler feed check valve; a spray burner for an oil-fired furnace; water gauge fittings; and numerous other examples.

Messrs. Best & Lloyd, Ltd.

(*Stand No.* 126, *Avenue* 15, *Bay* 16.)

On this stand a collection of fires and lighting fittings is exhibited. Among the former is a four-bar "Best" fire with separate switching for each bar. There is also an eight-bar fire with the elements arranged in pairs, each with separate switching. Among the lighting fittings are floor and table standards, candelabra, shade fittings, and brackets. One device shown is the "Best" quick-grip bowl fitting, a fitting made in various finishes with three flexible arms for sustaining a lighting bowl.

The India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

(*Stand No.* 31, *Avenue* 10, *Bays* 17 *and* 18, *and Stand No. C.*111, *Palace of Industry.*)

This company's exhibit in the Palace of Engineering forms a part of the Cable Makers' Association display, and consists of many samples of the company's cables, wires, &c. The stand in the Palace of Industry is incorporated in the India Rubber Manufacturers' Association's exhibit, and here are shown india rubber in a variety of manufactured and semi-manufactured forms—sheet, tube, hose, packings, tiling, belts, gloves, &c. Gutta-percha is also shown in numerous forms, including Chatterton's compound. Another section is devoted to ebonite manufactures, for example, battery containers, and other exhibits are golf balls, cables and wires, and telegraph instruments.

Messrs. Yarrow & Co. (1922), Ltd.

(*Stand No.* 247, *S.W. Block*, *Bays* 2 *and* 3.)

Upon this stand a large-scale model (about 14 ft. high) of the latest type "Yarrow" boiler is shown. This model is approximately one-third of full size, and is of the type which is being constructed for many power stations and factories at home and abroad. The boiler is fitted with the "Yarrow" patent superheater and air heater. The front casing is removed to enable the construction and design of the different parts of the boiler to be examined.

A model of a marine boiler, fitted with oil-burning apparatus, for a 12,000-h.p. turbine installation, is shown. The original "Yarrow" boiler (1887) is on view, and there are also actual examples and models of vessels built by the firm.

The Mullard Radio Valve Co., Ltd.

(*Stand No.* 102, *Avenue* 14, *Bay* 13.)

All types of thermionic valves are exhibited by this company. The receiving valves include the well-known "Ora" patterns and dull emitter valves. Rectifying valves of from 30 to 500 W dissipation are shown. Among the transmitting valves which appear are low-power types for from 5 to 40 W; medium-power valves for from 50 to 500 W; and high-power valves with silica envelopes. Valve accessories, including sockets and bases, condensers, resistances, filament rheostats, &c., are also displayed, as well as a "Holweck" high-vacuum pump similar to those used for the exhaustion of valves.

Messrs. C. A. Vandervell & Co., Ltd.

(*Stand No.* 105, *Avenue* 14, *Bays* 11 *and* 12.)

The principal exhibits on this stand are the firm's accumulators, the distinctive feature of which is the threaded-rubber separators employed. The batteries on view include special types for the lighting of trains, automobiles, &c., for engine ignition, and for signalling. Other examples of the company's manufactures are also shown, and, in addition, Messrs. Vandervell have a showcase exhibit in the Society of Motor Manufacturers and Traders exhibit in the Palace of Engineering, where they show automobile accessories of various kinds.

Messrs. Matthew Wylie & Co., Ltd.

(*Stand No.* 28, *Avenues* 6 *and* 7, *Bays* 12 *and* 13.)

This company's exhibit comprises machines for box nailing, by means of which packing cases and boxes can be made up; a double-colour woodprinting machine for imprinting names, designations, trade marks, &c., on wooden cases; and hand-hole boring machines for making grip slots in boxes. Several of these are driven by electric motors.

The Wireless Lights Syndicate, Ltd.

(*Stand No.* 127, *Avenue* 15, *Bays* 15 *and* 16.)

This company shows several examples of its electric signs which consist of glass tubing, mounted on plate glass or wooden panels, bent to form words or phrases. The tubing is filled with neon gas which upon the passage of a high frequency discharge emits the beautiful orange-coloured glow which is peculiar to this gas.

Messrs. Beck & Co., Ltd.

(*Stand No.* 159, *Avenue* 2, *Bay* 8.)

A large amount of water apparatus is shown by this firm. This includes valves of various patterns, fire-fighting appliances, hydraulic rams, apparatus for drilling and tapping water pipes while under pressure, and water meters for mains and boiler-feed systems.

The Acme Production Co., Ltd.

(*Avenue* 11, *Bays* 7-9.)

This firm is showing a number of radio receiving sets—valve and crystal, amplifiers, and component parts, "Acme" automatic and motor-driven flashers, and the "Texilscope" for the examination of precious stones and textiles.

Messrs. Sutcliffe (of Crumpsall), Ltd.

(*Stand No.* 77, *Avenues* 11 *and* 12, *Bays* 20 *and* 21.)

This display consists of vulcanised fibre in sheets, rods, tubes, and manufactured articles.

Contracts Closed.

(*Continued from page 578.*)

Belgian Congo.—La Société des Usines Bollinckx, of Brussels, has secured the contract for two engines for the electricity station which is being established at Kinshasa in the Belgian Congo.

Bradford.—Tramways Committee. Accepted:—
20 tons cast-iron track brake blocks (£200); 15 tons cast-iron Peckham hand-brake shoes (£157); and 10 tons cast-iron hand-brake shoes (£106).—Cole, Marchent & Morley, Ltd.

Electricity Committee. Accepted:—
Two 4,000-amp. control panels for two 1,500-kW rotary converters.—Metropolitan-Vickers Electrical Co., Ltd.
Steelwork and chequer plating for No. 7 turbo-generator.—H. Barrett and Sons, Ltd.
H.p. main steam piping for No. 7 turbo-generator at Valley Road works.—Babcock & Wilcox, Ltd.

Chester.—Board of Guardians. Accepted:—
Electrical fittings.—Wallworth & Co.

Colchester.—Town Council. Accepted:—
Tramway welding plant, rail grinder, and electrodes (£399).—Equipment and Engineering Co., Ltd.

Glasgow.—Education Committee. Accepted:—
Siemens's vacuum and gasfilled lamps.—Siemens & English Electric Lamp Co., Ltd.

Corporation. Recommended:—
Electric lighting installations at new pavilions at Bellefield Sanatorium (£256), Mr. D. Henderson; at Govan Baths (£488), and in connection with the Hawthorn Street housing scheme (£1,432), R. J. Sinclair.

Tramways Committee. Recommended:—
Magnetic brake equipment (30 sets) for new cars.—Metropolitan-Vickers Electrical Co., Ltd.
Commutators.—Dyer & Young, Ltd.
Metal screens for Baillieston sub-station.—Steele & Co.
Starting panel for Partick sub-station.—British Electric Plant Co., Ltd.
Heating oven for car bearings.—Manometer Manufacturing Co., Ltd.

Hull.—Tramway Rail Contract. The City Council on Thursday last week reversed its decision to purchase German-made tramway rails. The rescinding of the resolution was carried by one vote, 26 voting for and 25 against. No other tender was accepted.

London.—London County Council.—Highways Committee. Accepted:—
Constructing the foundations for No. 5 turbo-alternator at Greenwich power station (£3,492).—J. Garrett & Son
Electrically-driven tower wagon (£1,098).—Electromobile, Ltd.

Marylebone.—North-Eastern Railway. Accepted:—
Four electrically-driven 3-throw hydraulic pumps, fitted with variable speed motors.—Fullerton, Hodgart & Barclay.

Wimbledon.—Electricity Department. Accepted:—
"Utility" current limiters for 12 months.—Electrical Utilities, Ltd.

Forthcoming Events.

Electro-Harmonic Society.—Friday, October 17th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 4.30 p.m. Annual meeting.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, October 17th. At the Literary and Philosophical Society, Newcastle-on-Tyne. Presidential address by Mr. T. Westgarth.

Electrical Power Engineers' Association.—Saturday, October 18th. At the Hotel Cecil, London. At 5.30 p.m. Annual dinner.

Society of Technical Engineers (London Central Branch).—Tuesday, October 21st. At 102, Belgrave Road, S.W.1. At 7 p.m. Address by the chairman of the Executive Council on the "Past, Present, and Future Position of the Technical Engineer."

Institution of Marine Engineers.—Tuesday, October 21st. At the Institute, The Minories, E. At 6.30 p.m. Paper on "Present Tendencies in Steam Generation," by Sir Jas. Kemnal.

Electrical Trades Benevolent Institution (Manchester and District Section).—Tuesday, October 21st. At 6.30 p.m. Reception dinner.

Institution of Engineering Inspection.—Wednesday, October 22nd. At the Royal Society of Arts, John Street, Adelphi, W.C. Paper on "Crankless Engines," by Mr. A. Hamilton.

Institution of Electrical Engineers.—Thursday, October 23rd. At the Institution, Victoria Embankment, W.C. At 6 p.m. Presidential address by Mr. W. B. Woodhouse.

(Scottish Students' Section).—Friday, October 17th. At the Royal Technical College, Glasgow. At 7.30 p.m. Paper on "Interlocked Multi-motor Electric Drives for Paper Machines," by Mr. S. A. Knight.

(East Midland Sub-Centre).—Tuesday, October 21st. At Loughborough College. At 6.45 p.m. Paper on "Realisation of Heat Units in Steam and Electric Power Plant." by Mr. F. W. Nicholls.

(South Midland Centre).—Wednesday, October 22nd. At the Grand Hotel, Birmingham. At 6.45 p.m. Chairman's (Mr. W. Lawson) address.

Institution of Welding Engineers.—Thursday, October 23rd. At the Engineers' Club, Coventry Street, W.1. At 8 p.m Paper on "Steel Wire: its Manufacture, Properties, and Uses for Welding and other purposes," by Mr. E. A. Atkins.

Junior Institution of Engineers.—Friday, October 24th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette, "Powdered Fuel," by Mr. F. F. Evans.

Salesmanship Conference.—Friday, October 24th. At Caxton Hall, Westminster, S.W. At 7.30 p.m. Paper on "Contracting for Pleasure and Profit," by Mr. H. Marryat.

Manchester Association of Engineers.—Friday, October 24th. At the Engineers' Club, Manchester. At 7 p.m. Paper on "Costing and Works' Accounting, with special reference to Engineering," by Mr. R. Dunkerley.

Birmingham Electric Club.—Friday, October 24th. At the Grand Hotel, Colmore Row. At 7 p.m. Paper on "Heavy Oil Engines for the Generation of Electricity," by Mr. C. W. Chapman.

Physical Society of London.—Friday, October 24th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. First meeting of the 1924-25 session.

Notes.

The Electro-Harmonic Society.—We understand that members of this Society have been circularised calling the annual meeting for Friday (to-day) at 4.30 p.m. The Committee reports a net loss of 153 members during the past two seasons and the names on the register now number only 347. There has been a marked falling-off in attendance, though the quality and variety of the entertainments have been maintained at a high level. It is believed that the diminishing membership and attendance are due mainly to the halls in which the concerts have been held in recent seasons having proved uncongenial to the majority of the members, and in consequence the Committee has made strenuous but unsuccessful efforts to secure a more suitable hall centrally situated. The Committee reluctantly recommends that the operations of the Society should be suspended for the time being. A suggestion has been received by the Committee that an attempt should be made to establish a membership with a subscription of, say, five guineas per annum, in return for which every member would be entitled to a dinner prior to each concert. Under such an arrangement the difficulty of obtaining a suitable hall might disappear. This or any other suggestion will be welcomed at the meeting to be held this afternoon at the Institution of Electrical Engineers, Savoy Place, W.C.2.

Liverpool Electro-Harmonic Society.—We are pleased to learn that the inaugural concert of this Society, held last Friday, was in every way successful. Mr. Dickinson, Chief Electrical Engineer of Liverpool, was in the chair, supported by a representation of all branches of the trade, between 60 and 70 being present. Mr. Dickinson stated that he considered the Society would fill a gap and knit closer together the different sections of the industry in the hope that thereby some of the inevitable misunderstandings in a trade might be swept away in a social atmosphere. Mr. Oliver Moon, representing the Manchester Harmonic Society, wished the Liverpool Society every success, and stated that, judging from this, the first concert, he thought it would very soon at least equal the older one in Manchester. It has been decided that the future meetings will be held on the fourth Friday of each month, with the exception of December, when the day will be specially fixed.

Manchester Electro-Harmonic Society.—To-night (Friday), at the Albion Hotel, Piccadilly, Manchester, this society opens its sixth season. We understand that an excellent programme will be provided, and the following artists will take part:—Soprano, Miss Doris Kloet; baritone, Mr. Horace Brown; harpist, Mr. Charles Collier; entertainer, Mr. Ken Mackay; solo-pianist and accompanist, Mr. Ernest Cookson. A hearty invitation is extended to all connected with the electrical industry. Mr. J. A. Robertson will preside.

Local Societies.—Mining Electrical Engineers.—Mr. Routledge, electrical engineer for Messrs. Barker, Walker and Co., last week conducted a visit of inspection by members of the Yorkshire and Midland branches of the Association of Mining Electrical Engineers of the company's new electrical winding engines at Harworth colliery, near Doncaster. The engines, at full capacity, are capable of raising 300 tons of coal per hour. An inspection of the auxiliary power plant, the two 1,500-kW turbo-alternators, and the electrically-driven fan was also made.

Glasgow Corporation Engineering Society.—At the opening meeting of this Departmental Society, of which he is president, Mr. R. B. Mitchell, engineer and manager of the Corporation Electricity Department, gave an interesting address. Touching on the results of the department's operations for the past year, Mr. Mitchell observed that several records had been set up, the most notable being that of an output of over 200,000,000 kWh. During the evening two films, "Behind the Button" and "Electricity on the Farm," were shown.

Birmingham Electric Club.—In a recent lecture, Mr. W. N. Y. King, A.C.G.I., A.M.I.E.E., gave a brief historical survey of the development of the electric motor. The different characteristics of motors required for special purposes were pointed out, and developments in the future were considered as regards improvement in efficiency by the reduction of heat loss, also simplification of variable speed a.c. motor operation. The lecture was illustrated with a number of lantern slides.

Northampton Engineering College Engineering Society.—On October 20th, at 5.30 p.m., the presidential address will be given by Mr. S. C. Laws, M.A., M.Sc., and "The Power of the Flame," a film on welding, will be presented by Capt. Richardson.

Television.—In an address on "The Future of Wireless" to the Burnley Rotary Club last week, Mr. W. H. Thornton said few people realised that television was not only possible, but very near to accomplishment. It was now being done to a certain extent, and Prof. Lowe could tell in his laboratory whether his library fire, five miles away, was alight or not. He had not been able to focus it yet, but he had taken a great step in the direction of television.

Paisley Association of Electrical Engineers.—The 1924-25 session was opened with the delivery of the presidential address, Mr. J. M. Barbour taking as his subject "Joint Industrial Councils and Joint Boards," particularly with regard to electricity supply undertakings. A discussion followed.

British Standard Materials and Apparatus for Collieries.—At the request of the Mining Association of Great Britain the British Engineering Standards Association, as a result of a fully representative conference of all concerned, set up a sectional committee in June of this year with the object of preparing a limited number of British standard specifications for colliery materials and requisites.

It is hoped that by simplification and a reduction in the number of types and sizes and the preparation of standard specifications for the materials used, substantial economies will be brought about as has, in fact, been the case in all the other branches of the Association's activities.

The Sectional Committee has the fullest support of the Mining Association and of the local Coalowners' Associations, and through the assistance of the latter, local branches of the Institution of Mining Engineers, and other bodies, a number of Regional Committees in the larger coalfields have been set up in order that local practice may receive full and complete consideration in all the work undertaken by the Sectional Committee.

At the meetings of the Regional Committees it was felt that the work of the British Engineering Standards Association was not as widely known in the coal industry as it should be, and that detailed information of its work and some discussion of the principles underlying industrial standardisation would be of advantage to the progress of the work now being taken in hand. Mr. C. Le Maistre, C.B.E., the secretary of the British Engineering Standards Association, has therefore given a short address this week at Manchester and Cardiff, which will be repeated at the Mining Institute of Scotland, Royal Technical College, Glasgow, at 2.30 p.m. on Saturday, October 25th, and at the North of England Institute of Mining Engineers, Neville Hall, Newcastle-on-Tyne, at 3 p.m., on November 6th. General invitations to attend these meetings have been issued in each district, and it is strongly recommended that all who are interested in the subject should attend.

Belfast Electricity Supply.—The Belfast Harbour Power Station was put in operation on August 15th last year, and has therefore completed its first year's run, but power stations in the North of Ireland are outside the jurisdiction of the Electricity Commissioners, and the results of their working are not published in the fuel consumption returns. We have, however, received the following particulars from Mr. Johnstone Wright, M.I.E.E., city electrical engineer and manager, Belfast, which show that the new Harbour station compares favourably with others in the same group (25 to 50 million kWh per annum). As the station has not been running for a full year, March to March, the year ended September 30th has been taken. There is practically no night load in Belfast, and the load factor was 24.6 per cent. The data for the British stations are extracted from the Electricity Commissioners' Report on the Generation of Electricity in Great Britain, 1924:—

Station with lowest fuel consumption—Hackney Borough Council, 2.07 lb. per kWh.

Harbour Power Station fuel consumption—Year ended September 30th, 1924, 1.936 lb. per kWh; half-year ended September 30th, 1924, 1.956 lb. per kWh.

Station with highest thermal efficiency—Ayrshire Electricity Board, Kilmarnock, 15.73 per cent.

Harbour Power Station thermal efficiency—Year ended September 30th, 1924, 15.87 per cent.; half-year ended September 30th, 1924, 16 per cent.

Harbour Power Station thermal efficiency, based on I.C.E. Boiler Code formula for calorific value—Year ended September 30th, 1924, 16.7 per cent.; half-year ended September 30th, 1924, 16.86 per cent.

The thermal efficiency of the Harbour Power Station is based on the gross calorific value of the coal. Some of the British stations calculate their efficiency on the net or I.C.E. Boiler Code calorific value; Mr. Wright points out that this brings up the thermal efficiency by nearly 1 per cent., and the Harbour Station thermal efficiency is shown in the last two items of the above table on this basis.

Faraday House Old Students' Association.—The sixteenth annual dinner of this Association will be held at the Hotel Cecil on Friday, October 31st. Mr. R. N. Vyvyan, M.I.E.E., will be in the chair, and there is sure to be a large attendance. Members of the Association may introduce guests, who need not necessarily be Faradians. A musical entertainment will, as usual, follow the dinner, at which the following artistes will appear:—Miss Mayward-Webb (contralto); Miss Edith Eatherley (entertainer); and Mr. Ronald W. Gourley (blind pianist). Early application for tickets should be made to the hon. secretary, Mr. H. W. Fairman, Faraday House, Southampton Row, London, W.C.1.

Educational.—UNIVERSITY COLLEGE, LONDON.—The calendar for Session 1924-25 is, as usual, a voluminous work containing full particulars of courses in an exhaustive range of subjects, details of fees, lists of students, statutes, &c.

Arbitration.—On Monday, at the offices of the Law Association, 113, Chancery Lane, Mr. W. M. Selvey, the arbitrator appointed by the president of the Institution of Electrical Engineers, conducted an arbitration, Collie *v.* the Aldershot Gas, Electricity and Water Co. By desire of the parties the proceedings were conducted *in camera*.

Society of Technical Engineers.—The inaugural meeting of the London Central Branch takes place on Tuesday, 21st inst., at 7 p.m., at 102, Belgrave Road, S.W.1. The chairman of the Executive Council will deliver an address on "The Past, Present, and Future Position of the Technical Engineer." Engineers who are not members of the society can obtain tickets on application to the secretary, 102, Belgrave Road, S.W.1.

STAFF ENGINEERS AND THE GENERAL ELECTION.—The Executive Council of the Society of Technical Engineers has decided to invite candidates of all parties to address public meetings of professional engineers during the present election campaign. Meetings are being arranged by the Society in Newcastle-on-Tyne and several other centres. At the meetings no questions are to be allowed; the candidates will be invited to state their policy towards professional or salaried workers, such as employed technical engineers, who claim to occupy a third-party position in industry. Where meetings cannot be arranged candidates are to be asked to speak on the above subject at one of their own election meetings.

Electric Lighting at the British Empire Exhibition.—Referring to the article on the above subject in our last issue, mention should have been made of the important part played by Messrs. Siemens & English Electric Lamp Co., Ltd., in illuminating the Exhibition. Siemens projector type lamps are extensively used for flood-lighting the buildings, grounds, shrubs, &c., and the North West Gardens are illuminated with their colour-sprayed enamelled lamps. In addition, the Indian Pavilion and large numbers of exhibitors' stands, side-shows, &c., have used Siemens electric lamps very extensively. The "Racer" is lighted throughout with some thousands of Siemens frosted lamps.

Accident.—An electrician named Frederick Sheasby, of Camp Hill, Birmingham, was severely injured whilst at work in the power station of Messrs. Williams Bros. & Piggott, brass founders, Small Heath. Sheasby was at work at the switch panels where the power supply from the Birmingham Corporation enters the works, when a defect gave rise to a flame. The top of the switch was blown off, and Sheasby received a shock and burns.

Appointments Vacant.—Plumber-jointer for Wolverhampton Corporation Electrical Engineering Department. Switchboard attendants for Lancaster and Newport (Mon.) Corporation Electricity Works. Junior assistant in the meter department of the Dover Corporation Electricity Works. Telephone engineers for the United River Plate Telephone Co., Ltd. Engineer to take charge of mains, meters and installation department (£200), for the Stratford-on-Avon Electricity Co., Ltd. (See our advertisement pages to-day.)

Legal.—ELECTRICAL CONTRACTS & MAINTENANCE CO., LTD.—Mr. Justice Eve, in the Companies Winding Up Court, on Tuesday, made an order for the compulsory winding up of Electrical Contracts and Maintenance Co., Ltd. The petitioning creditors were the General Electric Co., Ltd.

ELECTRICAL CABINET WORKS, LTD.—In the Companies Winding Up Court, on Tuesday, Mr. Justice Eve, on the petition of M. Lewis (Timber), Ltd., judgment creditors, made an order for the compulsory winding up of this company.

The Electrical Trades Benevolent Institution.—The annual festival of this Institution will be held on Wednesday, November 19th, at the Trocadero Restaurant, London, at 7.30 p.m., when Mr. Dane Sinclair will preside. The price of single tickets, exclusive of wine, will be £1 1s., and the tickets for a lady and gentleman £1 11s. 6d.; they can be obtained from the hon. secretary, Mr. F. B. O. Hawes, M.I.E.E., at 93, Grosvenor Road, London, S.W.1.

MANCHESTER SECTION.—A dinner and dance organised by the Manchester and District Section, will be held at the Midland Hotel, Manchester, on October 21st. Sir Philip Nash, K.C.M.G., C.B., will preside, and has issued an appeal for donations to the funds of the Institution. The particular purpose of this social effort is to augment the funds and to create a broader and more active local interest in the good work of the Institution. Sir Philip will be supported by a number of prominent gentlemen, including Mr. W. B. Woodhouse, the new president of the Institution of Electrical Engineers. The price of tickets, exclusive of wine, is, gentlemen £1 1s., ladies 16s. 6d.

In the course of his appeal, after reviewing the history of the E.T.B.I., Sir Philip Nash said it was incumbent on those who had been able to make more than a living out of the industry to spare something to relieve the distress of those who were, in a sense, pioneers; having helped, though possibly in a humble capacity, to smooth the road over which we travel now. Up to the present the Institution had been unable to carry out the second of its objects, namely, the provision of pensions, because these could only be paid from interest, and the invested funds only amounted to a little over £22,000. The governors and committee were aiming to get together £50,000, which they felt would provide adequate interest to enable pensions to be allotted in the worst cases. Particulars can be obtained from the local hon. secretary, Mr. F. G. Quance, Magnet House, Victoria Bridge, Manchester. If circumstances prevent attendance, contributions will be gratefully received and acknowledged by Sir Philip or by the local hon. secretary.

Large Steam Turbo-Generators.—A paper on the above subject was to be read before the American Institute of Electrical Engineers on October 15th by Messrs. W. J. Foster, E. H. Freiburghouse, and M. A. Savage, all of the General Electric Co., of Schenectady. In some ways the paper may be looked upon as a statement of the results which have been obtained with the largest machines recently built by the American "low temperature" school of turbo-alternator designers. In this way it is a reply to the suggestion that owing to mechanical difficulties, the largest machines cannot be built for low temperature rises. The paper raises important considerations with regard to temperature and the method of determining it, protection against fire, and operating conditions concerning which more will be said in a later issue. At the moment it will suffice to point out that it is recommended that:—

1. Overloads in excitation be avoided.
2. Such arrangements of ventilation be adopted as will permit as little cooling of the rotor when at rest as possible, and on no occasion permit the entrance direct of outdoor air.
3. A practice be established of determining the temperature of the field winding at stated intervals by observing the voltage at the collector rings and comparing it with that obtained with the same load conditions when the generator was first put into service.
4. Insulation resistance be measured at the same stated intervals.
5. If for any reason at any time the rotor at rest has become very cold, it should be run at low speed with sufficient excitation to bring its temperature up to about 75 deg. Cent. in about one-half hour before raising the speed to normal.

Electric Cooking.—As we go to press we have received the following letter:—

After reading Mr. Sam Hall's letters which have appeared with mine in the "Correspondence" columns of the Electrical Review on the subject of "The Modern Electric Flat," I am sure my electrical friends will be cheered if they turn up the advertisement of a certain gas cooker which appeared in the *Radio Times* on the 10th instant. The following perfectly priceless points are claimed by the makers of this cooker:—

"No burners in the oven.

No flues where live gas can collect to cause an explosion.

Owing to the oven being entirely closed in, an enormous reduction is effected in gas consumption.

Dirt and germ-laden dust from floor cannot be drawn on to food or on to liquid fat in drip-pan whilst stove is in use because bottom of oven is entirely closed.

Mice cannot get into the oven and drip-pan, leaving all kinds of dangerously infectious disease germs.

Oven cloths cannot be set alight when taking things out of the oven.

Temperature in oven is not lowered by a sudden draught when an outside door is opened. (This point will be much appreciated by a first-class cook.)

Dishes and plates when placed in oven to be heated cannot be cracked by contact with flames.

The juices of meats are retained to a remarkable extent, and the shrinkage is far less, thus improving quality and nutriment and making every joint yield more "helpings."

Perfect control of the oven, thus ensuring efficiency and economy."

No wonder the people who have been using all other makes of gas cooker are so eagerly adopting the electric method. Electricity offers all these advantages and more. I would not have dared to recite all the well-known disabilities and dangers of gas cookers. It would be such bad form to run down a competitor's goods.

But now the cat is out of the gas bag, and we can safely hand on the word of the gas stove manufacturer.

L. L. Robinson,
Borough Electrical Engineer, Hackney.
October 13th, 1924.

Stepney Staff to Celebrate 25th Birthday.—The Stepney electricity works technical staff are holding their fifth annual dinner at the Abercorn Rooms, Liverpool Street Hotel, on Friday, December 19th. Mr. W. C. P. Tapper (president of the I.M.E.A.) will be in the chair, and to mark the fact that the undertaking completes its 25th year of supply it is to be a ladies' night. Old members of the staff are invited to communicate with the secretary, Mr. W. F. Andrews, at 27, Osborn Street, London, E.1.

Institution Notes.

Institution of Electrical Engineers.—Mr. W. B. Woodhouse, the new president, will deliver his inaugural address at the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, W.C.2, on Thursday next, October 23rd, at 6 p.m. Later events in the programme for the session are announced as follow:—

November 6th.—"An Electric Harmonic Analyser," by J. D. Cockcroft, R. T. Coe, J. A. Tyacke, and Prof. Miles Walker, D.Sc.
November 20th.—"Automatic and Semi-Automatic Rectifier Sub-stations," by G. Rogers.
December 4th.—Lecture on "Gyroscopic Pendulums," by Prof. J. G. Gray, D.Sc., and Mr. J. Gray.
December 18th.—"Speeding up the Telegraphs: A Forecast of the New Telegraphy," by D. Murray.
January 8th, 1925.—"Three-wire Direct-current Distribution Networks: Some Comparisons in Cost and Operation," by Herbert W. Taylor.
April 23rd.—The sixteenth Kelvin Lecture.

North-Eastern Centre.—The first meeting of this Centre will take place at Newcastle-on-Tyne on October 27th, when the chairman will deliver his address. On November 10th the meeting will be occupied with a paper by Mr. Bartholomew on "Power Circuit Interference on Telegraphs and Telephones." Prof. G. W. O. Howe will give his Faraday Lecture on "World-Wide Radio Telegraphy" at Newcastle on December 17th.

Scottish Centre.—The following are some of the arrangements of this Section for the 1924-25 session. The Glasgow meetings will be held at 207, Bath Street, excepting the informal gatherings, and the Edinburgh meetings at the North British Station Hotel:—

November 11th, 1924.—First meeting, Glasgow. Chairman's inaugural address, by Mr. Alex. Lindsay.
November 25th.—Informal meeting, Glasgow.
December 9th.—Glasgow. Paper, "An Electric Harmonic Analyser," by Prof. Miles Walker.
December 16th.—Dinner, Grosvenor Restaurant, Glasgow.
January 13th, 1925.—Edinburgh. Paper, "Automatic and Semi-Automatic Rectifier Sub-stations," by Mr. G. Rogers.
January 20th.—Informal meeting, Glasgow.
February 10th. Glasgow. Paper, "Three-wire Direct-current Distribution Networks: Some Comparisons in Cost and Operation," by Mr. H. W. Taylor.
February 17th.—Faraday Lecture, Edinburgh, by Dr. G. W. O. Howe.

Scottish Students' Section.—This Section meets at the Royal Technical College, Glasgow, to-night (Friday), when a paper on "Interlocked Multi-motor Electric Drives for Paper Machines" will be read by Mr. S. A. Knight. To-morrow (Saturday) afternoon a visit is to be paid to the shipyards of Messrs. J. Brown & Co., Clydebank. On Friday, November 7th, there is to be a smoking concert.

French Society of Electricians.—Congress.—A special congress of the Société Française des Electriciens is to be held in Paris from December 26th to 31st next, when papers will be read on electricity generation and supply, electric traction, electrochemistry, telegraphy, telephony, &c.

Institution of Engineers and Shipbuilders in Scotland.—On October 14th a paper was to be read on "Pulverised Fuel in its Commercial Aspect," by Mr. Alfred J. T. Taylor, of Toronto; the discussion will take place on October 28th. Amongst the papers to be read during the new session are the following:—"A New Electric Drive for Ship and Other Auxiliaries," by Mr. Gilbert Austin; "The Further Development of Large Power Diesel Engines," by Mr. W. D. McLaren; "Steam Piping," by Mr. J. Arthur Aiton, C.B.E.; and "Hydro-Electric Power Transmission," by Mr. F. A. Gaby, of Toronto. The "James Watt" dinner will be held in the Grosvenor Restaurant, Glasgow, on Friday, November 21st.

Junior Institution of Engineers.—On October 10th, Mr. N. Thornton, A.M.I.E.E., read a paper on "The Design of Static Sub-stations, with some notes on their Equipment." After mentioning the main requirements of a sub-station building, the paper dealt with sub-station equipment under four headings, (1) H.p. switchgear, (2) static transformers, (3) l.p. switchgear, and (4) cables, connections and auxiliary apparatus. The paper concluded with descriptions of types of sub-stations for large and small industrial and lighting loads, the designs varying not only with the size and disposition of the plant, but with the locality in which the sub-station was to be built, and being influenced also by the possibility of future development.

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review posted as to their movements.

Mr. H. Worsdall is leaving the Igranic Electric Co., Ltd., Bedford, to take up an appointment as sales engineer with the Riley Stoker Co., Ltd., of Westminster, S.W.1.

Mr. C. D. King, A.M.I.E.E., has relinquished the position of chief engineering assistant to the Worcester City Electricity Department and is removing to London. At a farewell gathering of the staff and employés of the works, Mr. King was presented with a clock and a case of pipes; he asked the Recreation Club to accept the clock for the Club room. Mr. King had charge of the removal of the plant described in our issue of May 30th and its re-erection at Worcester.

It is reported in the Press that Sir Ernest Clark, K.C.B., Permanent Secretary to the Treasury of Northern Ireland, will relinquish his position under the Ulster Government at the end of this year, in order to take up an important post with the Underground Electric Railways Company of London, at Lord Ashfield's invitation.

Mr. Q. Arbuckle, mains assistant at Bradford Corporation Electricity Works, has been appointed mains engineer to the Bournemouth and Poole Electricity Supply Co., Ltd.

MR. HARRY HUGHES HARRISON, M.I.E.E., is the new chairman of the Mersey and North Wales (Liverpool) Centre of the Institution of Electrical Engineers, before which he will deliver the inaugural address on November 3rd. Mr. Harrison entered the British Telegraph Service on the operating side, and after three years he was transferred to the Testing Branch. He received his early instruction in telegraphy and telephony from Mr. (now Sir) William Slingo. He left the Telegraph Service after a few years to go into heavy mechanical engineering, at which he remained for eleven years, subsequently entering the service of the British Insulated & Helsby Cables, Ltd., in London, on the engineering staff. Later Mr. Harrison joined the engineering staff of the Automatic Telephone Manufacturing Co., Ltd., of

Richard Brown] [*Liverpool.*

Mr. H. H. Harrison,

Chairman of the Mersey and North Wales (Liverpool) Centre of the Institution of Electrical Engineers.

Liverpool. He was the author of a paper read before the I.E.E., and awarded the Fahie premium, on "The Principles of Modern Printing Telegraphy." He has contributed professional papers to the Post Office Electrical Engineers on the historical basis of modern printing telegraphy and on the story of the Keyboard Perforator. Books to his credit are: "Printing Telegraph Systems and Mechanisms" (Longman's Series of Telegraph and Telephone Engineering Manuals), edited by Sir Wm. Slingo; and "An Introduction to the Strowger System of Automatic Telephony" (Longmans). Mr. Harrison has served on the Council of the Institution of Electrical Engineers, and is a member of the Institution of Railway Signal Engineers.

It is announced that Lord WARGRAVE has been appointed chairman of the Westminster Electric Supply Corporation, Ltd., owing to the resignation of Captain E. I. Bax, who has been elected deputy-chairman.

Mr. F. W. HODKIN, B.Sc., A.I.C., formerly senior research assistant in the Department of Glass Technology at Sheffield University, has received the appointment of manager of the Edison Swan Electric Company's glass works at Ponders End.

The marriage took place at the Parish Church, Rugby, on October 1st, of Mr. RANDALL GARFIELD HOSKING, assistant works manager of the British Thomson-Houston Co., Ltd., Rugby, and Mrs. Agatha Mary West, widow of Lieut.-Col. F. West, and daughter of the late Mr. William Dewar, of Horton House, Rugby.

Mr. E. W. PETTER, President of the British Engineers' Association and chairman of Petters, Ltd., left Liverpool on Friday on a business visit to Canada and the United States.

Mr. A. W. FITHIAN is leaving the A.F.A. Accumulators, Ltd., at the end of this month.

Nelson Town Council has decided to increase the salary of its electrical engineer and tramway manager by £47 10s. per annum.

Obituary.—HERR T. KARRASS.—The death is announced from Berlin, at the age of 78 years, of Herr Theodor Karrass, the Chief Engineer of the German Telegraphs.

MR. H. S. MILLINGTON.—We regret to record the death, which occurred on October 6th, of Mr. H. S. Millington, works manager for Messrs. George Ellison, of Birmingham, with whom he had been for 17 years. Mr. Millington, who had not enjoyed good health for the last two years (but would not be persuaded to rest), was held in high esteem by the staff and workpeople.

MR. C. H. CLAYFORD.—The death is announced at the age of 51 years, of Mr. Charles Henry Clayford, who had for over 20 years been manager of the Newmarket Branch of Messrs. Baily, Grundy & Barrett, electricians, of Cambridge.

New Companies Registered.

G. and L. Electrical Supply Co., Ltd. (200,874).—Private company. Registered October 8th. Capital, £1,000 in £1 shares. To adopt an agreement with Meshe Gevirtzman, trading as the G. and L. Electrical Supply Co., and to carry on the business of suppliers of electrical fittings and appliances, &c. The subscribers (each with one share) are:—E. A. Moses, 29, St. George's Road, N.W.6, secretary; B. Cox, 33, Merton Avenue, Chiswick, W., accountant. M. Gevirtzman, dealer in electrical and wireless fittings, is the managing director. Qualification, £20. Secretary: E. A. Moses. Solicitor: S. Landman, Sentinel House, Southampton Row, W.C.1. Registered office: 1, Warwick Court, Holborn, W.C.

Keumac Radio, Ltd. (200,852).—Private company. Registered October 6th. Capital, £100 in £1 shares. To carry on the business of manufacturers of and dealers in apparatus for wireless installations, &c. The first directors are:—W. S. Petrie (chairman), 24, Carlton Mansions, Portsdown Road, W.9; D. M. Mackie (managing director), 101, Gleneldon Road, Streatham; G. K. Petrie (managing director), The Nook, Shiplake-on-Thames (director of Moyang Tea Co., Ltd.). Qualification, 1 share. Solicitors: Forbes & McLean, 8, Queen Street, E.C.4. Registered office: 196, Church Street, Kensington, W.8.

Wheeler & Sons (Engineering), Ltd. (200,840).—Private company. Registered October 4th. Capital, £100 in 1s. shares. To carry on the business of consulting engineers, electrical engineers and contractors, suppliers of electricity, carriers of passengers and goods, manufacturers of and dealers in electric, magnetic, galvanic and other apparatus, &c. The subscribers (each with one share) are:—H. W. Love, 8, Longstaff Crescent, Wandsworth, S.W.18, clerk; N. J. Stevens, 48, Oxford Road, Ponders End, Middlesex, clerk. The first directors are not named. Solicitors: Wordsworth, Marr, Johnson & Shaw, 39, Lombard Street, E.C. Registered office: St. Stephen's House, Westminster, S.W.

Standard Accessories Co., Ltd. (200,833).—Private company. Registered October 4th. Capital, £500 in £1 shares. To carry on the business of electricians, wireless apparatus manufacturers and vendors, gramophone manufacturers, sports equipment manufacturers, cycle and motor-car manufacturers, &c. The subscribers (each with one share) are:—H. A. Kaplan, 70a, Portsdown Road, Maida Vale, W.9, merchant; Mrs. L. Kaplan, 70a, Portsdown Road, Maida Vale, W.9. The first directors are not named. Solicitors: C. Butcher and Simon Burn, 32, Gresham Street, E.C.2.

Northleach Electric Supply Co., Ltd. (200,830).—Private company. Registered October 4th. Capital, £3,000 in £1 shares. To carry on the business of an electric supply company, &c. The first directors are:—A. E. Moss, J.P., Leygore Manor, Northleach; F. W. Gardiner, Northleach; F. Arkell, Church Farm, Northleach; J. Atkins, 1, Thames Street, Windsor; J. H. Stephens, Northleach; C. Hyde, Northleach; W. Clark, Northleach. Qualification: £50 shares. Remuneration as fixed by the company. Secretary: A. D. Ward. Solicitor: J. H. Stephens, Northleach. Registered office: Bank Chambers, Northleach, Glos.

Aero-Dynamos (200,918).—Registered as a private company on October 10th, with a nominal capital of £10,000 in £1 shares. The objects are:—To acquire from the Ventimotor Aktiengesellschaft, of 7, Kettbusser Ufer, Major Kurt Bilau, of 121D, Potsdamer-privat Strasse, Ludwig Blumschein, and Ventimotor Bilau and Co., both of 7, Kettbusser Ufer, all in Berlin, and Teuvie Wolk, of the National Liberal Club, Whitehall Place, S.W.; and turn to account certain rights in an invention known as "Nilau's Ventimotor," to acquire the British and other patents and certain rights in processes relating to wind-driven power generators, to adopt an agreement with the said vendors and D. Carruthers, junr.; to acquire British patent No. 206,160, of 1924, and patent application No. 20,470/24, and to carry on the business of manufacturers of machines, engines, electrical and other machinery and apparatus and instruments and parts thereof, &c. The subscribers are:—A. K. E. Hampshire, 3, Ryder Street, S.W.1, 75 shares, insurance broker; F. N. Sanderson, 14, Ridinghouse Street, W.1, 10 shares, insurance broker. The first directors are:—D. Carruthers, junr., T. Wolk, F. N. Sanderson, J. W. Drysdale, and J. H. Nellis. No notice of situation of registered office was filed at the time of incorporation.

Trent Bridge Radio Co., Ltd. (200,662).—Private company. Registered September 26th. Capital, £400 in £1 shares. To carry on the business of manufacturers of wireless and electrical apparatus, &c. The first directors are:—M. Orgel, 96, Petherton Road, Canonbury, N.5; L. G. Cooper, Main Street, Barton-under-Needwood, Burton-on-Trent. Qualification: 10 shares. Solicitor: P. S. Costerton, 190, Bishopsgate, E.C.2. Registered office: 27, Derby Road, Nottingham.

General Battery Co., Ltd. (200,876).—Private company. Registered October 8th. Capital, £2,500 in £1 shares (20 ordinary and 2,480 10 per cent. cumulative preference). To carry on the business of electrical and general engineers, dealers in or agents for electrical batteries and appliances, &c. The first directors are:—E. J. Wade, 15, North End Road, Golders Green, N.W.11, motor engineer (permanent); G. M. Chantrill, 1, The Grove, Golders Green, N.W.11, electrical engineer (managing director). Remuneration as fixed by the company. Solicitor: B. F. Browne, 17, Hart Street, Bloomsbury, W.C.1. Registered office: 47, Campbell Road, Finsbury Park, N.4.

Official Returns of Electrical Companies.

Comac Manufacturing Co., Ltd.—R. M. Ward, of 44, Church Road, Barnes, S.W., ceased to act as receiver for debenture holder (under appointment dated February 12th, 1923) on September 30th, 1924.

British Scientific Industries, Ltd. — A. Dobson, of Post Office House, Infirmary Street, Leeds, ceased to act as receiver on September 30th, 1924.

Hemm & Lambert, Ltd.—Satisfaction in full on May 1st, 1924, of debenture dated September 29th, 1922, securing £2,000. (Notice filed October 4th.)

Scholey & Co., Ltd. (in liquidation).—Satisfaction in full on September 25th, 1924, of prior lien debenture dated November 29th, 1923, securing £1,200.

Watford Electric and Manufacturing Co., Ltd.—Satisfaction to the extent of £500 on August 30th, 1924, of debenture dated May 31st, 1923, securing £3,000.

Neutron, Ltd.—Particulars filed on October 3rd of £300 debentures authorised May 28th, 1924, charged on the company's undertaking and property, present and future, including uncalled capital; the whole amount being now issued.

Welwyn Garden City Electricity Supply Co., Ltd.—Debenture dated September 29th, 1924, to secure £20,000 charged on the company's property, present and future, excluding uncalled capital. Holders:—Welwyn Garden City, Ltd.

Ilfracombe Electric Light and Power Co., Ltd.—Mortgage dated September 10th, 1924, to secure £10,000, charged on the undertaking authorised by the Ilfracombe Electric Lighting Order, 1898 (including all land, buildings, works, materials and plant belonging thereto or used therewith), and all moneys receivable in respect thereof, and certain lands and buildings in Ilfracombe, subject to certain rights of way. Holders:—Edmundson's Electricity Corporation, Ltd.

Isle of Thanet Electric Supply Co., Ltd.—Satisfaction in full on July 31st, 1924, of mortgages or charges (*a*) dated August 5th, 1902, securing £40,000, (*b*) dated July 6th, 1904, securing £50,000, (*c*) dated March 16th, 1916, securing £1,000, and any further sums which may be paid under a joint and several promissory note for £3,000, (*d*) of same date securing £6,000 and any further sums which may be paid under a joint and several promissory note for £3,000, (*e*) of same date securing any sums which may be paid under a joint and several promissory note for £3,000, (*f*) of same date securing £2,500 and any further sums which may be paid under a joint and several promissory note for £3,000, (*g*) of same date securing £2,500 and any further sums which may be paid under a joint and several promissory note for £3,000, (*h*) dated October 25th, 1917, securing £1,500 and further sums which may be advanced, (*i*) dated March 5th, 1918, securing £17,500, and (*j*) dated December 6th, 1921, securing £17,500.

Llandudno and Colwyn Bay Electric Railway, Ltd.—Trust deed dated September 1st, 1924 (supplemental to trust deeds dated July 27th, 1909, and April 28th, 1911) to secure £100,000 debenture stock and premium of 5 per cent., including £50,000 outstanding under principal deed, charged on the "Railway Undertaking," as defined by the original deed and the present indenture, and a floating charge on the company's other assets, present and future. Trustees:—Trustees Corporation, Ltd., Winchester House, Old Broad Street, E.C.

Power and Traction Finance Co. (Poland), Ltd.—Trust deed registered October 1st, 1924, to secure £1,250,000 5 per cent. guaranteed debenture stock 1924-1944 (guaranteed as to principal and interest by H.M. Government under the provisions of the Trade Facilities Act as extended and amended by subsequent legislation). The deed constitutes a charge on money lent on mortgage to certain companies in Poland, with the securities for such moneys; all shares in the capital of certain companies in Poland or any of them then or at any time thereafter held or owned by this company or to which it was then or should thereafter become in any way entitled; all moneys for the time being standing to the credit of a "Trustees Account" referred to in the trust deed, and all investments (including deposits with banks) in which any such moneys may be temporarily invested as therein mentioned; all other property and assets of every description which may be acquired with any moneys standing at the credit of the said account, or upon which any such moneys may be laid out or invested; and all the company's lands, hereditaments, buildings, plant and machinery, present and future. The trustees for the debenture stock holders are the British Overseas Bank, Ltd., 36, Gracechurch Street, E.C. Stock not exceeding £900,000 (nominal) which may be issued to the Prudential Assurance Co., Ltd., is to be issued to them at a discount of 3 per cent. as provided by the trust deed.

Mickelwright, Ltd. — Satisfaction in full on May 2nd, 1924, of mortgages dated April 28th, 1919, and September 20th, 1922, securing £250.

City Notes.

Fellows Magneto Co., Ltd.

Mr. V. L. Fellows presided at the annual meeting on October 9th. He said that the actual business result for 1923 was not by any means so unsatisfactory as the accounts showed. The heavy loss was not due to trading of the year, but to bad debts belonging to the slump of 1920-21, which hit the motor trade seriously. The actual trading loss for the year was due to the failure of the magneto side of the business to absorb its share of overhead charges, owing to the severely cut selling prices, and to the initial cost of creating a wireless goodwill. Realising that the magneto business alone would not give the company a profit, the directors' policy had been to push ahead with the wireless business which could show satisfactory profits. The company had developed this business extensively, and it was still expanding, the sales for the summer months of this present year, although the quiet season, being over six times the amount for the corresponding period of 1923. They had reached the stage where their wireless turnover was considerably in excess of their magneto turnover. The former was profitable, while the latter, at present, was not profitable. At the same time there were definite signs of improvement on the magneto side.

In connection with the wireless business, in 1923 they had naturally not been able to undertake the manufacture of many of the accessories required and, therefore, had to purchase them—loud speakers, coils, valves, &c. Their customers being practically all "trade" customers, the company had had to give away on these items nearly all the discounts received, so that a large portion of their turnover thus showed no profit, but rather the loss incurred on the resale. Those orders had to be accepted. This defect, however, had been gradually remedied, and they were to-day manufacturing on a satisfactory profit basis their own loud speakers, coils, and all parts hitherto purchased, and had reached a final stage in negotiations for the sole selling rights in a patented valve, which showed a satisfactory profit after allowing the highest trade discount.

In the first seven months of the year under review the proportions of sales were magnetos 52½ per cent., wireless 47½ per cent. For the corresponding period of the present year the proportions were: magnetos 33 per cent., wireless 67 per cent., showing a very satisfactory increase in the profitable side of the business.

When the proposal to adopt the report was seconded, discussion arose, in the course of which it was apparent that there were differences of opinion among the directors, and in the end an amendment was carried by 28 votes to 17 adjourning the meeting until November 10th and authorising two directors (Messrs. F. de C. Montfort and J. J. Middleton) to consult a financial expert in regard to the affairs of the company.

Aluminium Corporation, Ltd.

Mr. K. M. Clark presided at the annual meeting held in London on October 8th. In going through the balance sheet he said that £107,903 had been expended during the year on the extension of the power plant—£69,000 was in connection with the low-level dam and leets and work on the Llugwy and Cowlyd dams, £19,000 on buildings and structures at Dolgarrog, including an extension to the old power house and also to the recast shop, and certain work on the rolling mill, while £12,000 was expended on new plant and machinery and rolling stock, and a further £8,000 on the acquisition of land and developments in regard to housing. The depreciation reserve on plant and machinery had been increased to £34,000. Sundry debtors showed an increase of £23,000, which was in accordance with their increased turnover, while stocks were decreased by £32,500. The year 1923 was a somewhat less difficult one than 1922 for the industry. Their sales were considerably increased, though prices did not until the end of the period show any improvement. They had succeeded, after many difficulties, in increasing their water storage capacity, and had placed orders for the installation of a second and larger pipe-line, which they had hoped would be in operation by March of this year, but they were only now reaching its completion. The contractors were engaged in linking the connections from the pipe-line to the power-house. The first 5,000-kW turbine and generator had been erected.

The works were at present operating to the full capacity of the plant installed. There seemed to be no sign of slackening in the aluminium market. They had completed negotiations which would enable them to connect, by means of a tunnel, the Eigiau and Cowlyd Lakes, and thus conserve a considerable quantity of water that at present went to waste. This contract they hoped to place in the very near future. Since the Government guarantee was made in connection with the North Wales Power Co.'s debenture issue, work had been actively proceeding on the extension of the transmission system, and the lines had been built from Dolgarrog to Hawarden. Work on the line from Hawarden to Wrexham was well advanced, and it was hoped to place a contract for the construction of the line from Wrexham to Crewe at a very early date, so that the directors hoped that during the coming year they would be supplying the Power Co. with a considerable block of energy that would be transmitted direct from Dolgarrog to the works of the London, Midland and Scottish Railway at Crewe.

Zurich Bank for Electrical Undertakings.

The report for 1923-24 of the Bank für Elektrische Unternehmungen, of Zurich, states that the reorganisation of the undertaking has provided a new basis, thanks to which the company has regained complete freedom of action and capability of development. It is believed that the worst point of the general economic conditions has been passed. In connection with the change from a paper to a gold mark basis the report states that as the preponderating part of the shares of the German electricity works was, and remains, invested in reproductive values (central stations and mains), the concern has, on the whole, at least been spared the consumption of its own assets, an experience that has taken place in the case of many German companies. On the new basis a suitable return should be obtained on the reduced capital of the German companies. Concerning the supply of energy it is mentioned that the demand for power in Switzerland has again rather increased, a large portion of the power finding an outlet for export purposes. In Germany, however, a perceptible diminution in the sale of energy is recorded owing to the industrial crisis, but this disadvantage has been partly counteracted by the obtaining of better and more stable prices. As to the operations of the Bank in other countries, the report states that Austrian business has chiefly been brought within its scope. As mentioned in a previous issue the Bank proposes to pay a dividend at the rate of 7 per cent. on the A and B shares as compared with 6 per cent. in the previous year, these results following some years of inability to make any distribution. The *Financial News* quotes the report as stating that the Cia. Hispano-Americana de Electricidad S.A., in which the Bank has a substantial interest, has sold out its Santiago and Valparaiso investments to a British group. On the other hand, the Bank has acquired a participation in the Société International d'Energie Hydro-Electrique, which intends to reorganise the Mexico Tramways Co. and the Barcelona Traction, Light & Power Co.

International Light and Power Co.

The total income for the year ended June 30th last was £70,612, and after deducting debenture interest, &c., and adding £28,283 brought forward, a balance of £68,012 remains. £2,500 is transferred to reserve for contingencies, £15,000 is written off loans to subsidiaries, and the payment of fifteen months' arrears on the preference shares absorbs £20,079, leaving £30,433 to be carried forward. A further distribution has since been made on the preference shares, leaving dividends 15 months in arrear. A meeting of the English shareholders is to be held on October 20th.

German Companies.

The report of the *Hartmann and Braun Company*, of Frankfort-on-Main, states that the works have been abundantly supplied with orders in 1923, and it was possible again to strengthen some foreign connections. Owing to the uncertain economic conditions the directors are unable to say anything regarding the future prospects.

The shareholders in *Brown, Boveri & Co.*, of Mannheim, have approved the initial gold mark balance sheet under which the capital has been reduced from paper marks to 5,000,000 gold marks. The hope is expressed by the directors that the undertaking has been placed on a sound basis and that there will be a better return obtainable in the future when a somewhat normal economic situation prevails.

French Companies.

La Société Nouvelle de l'Accumulateur Fulmen, 18, Quai Clichy, Paris, is increasing its capital from 1,200,000 to 1,800,000 fr.

La Société de l'Energie Electrique du Littoral Mediterranean, of Paris, has decided to increase its capital from 125 million to 175 million francs by the issue of 100,000 new shares of 500 fr. each.

Shawinigan Water and Power Co. — According to the *Financial Times* this company is issuing an additional $2,000,000 of capital stock to shareholders at par, $100 a share, in the proportion of one new share for each ten shares presently held. The proceeds will be applied to the company's participation in the new United Securities, Ltd., which has secured control of the Montreal Tramways and Power Co. and subsidiaries.

Stock Exchange Notice.—The undermentioned has been ordered to be officially quoted :—

Whitehall Electric Investments.—1,000,000 seven-and-a-half per cent. cumulative preference shares of £1 each, fully paid, Nos. 6,500,001 to 7,500,000 and £1,000,000 six per cent. first mortgage debenture stock.

Deal and Walmer Gas and Electricity Co.—The profit for 1923-24 was £6,068, and to this is added £2,593 brought forward. A final dividend of 3½ per cent. (making 7½ per cent. for the year) has been declared.

Anglo-American Telegraph Co., Ltd.—Interim dividends for the quarter ended September 30th have been declared as follows :—Ordinary stock 15s. per cent.; preferred stock £1 10s. per cent.

Indo-European Telegraph Co., Ltd.—Interim dividend for the half-year to June 30th, 1924, at the rate of 5 per cent. per annum, free of tax.

Western Union Telegraph Co.—A quarterly dividend of 1¼ per cent. is announced.

Stocks and Shares.

MONDAY EVENING.

With the election campaign fairly launched, the effect upon the Stock Exchange has been somewhat remarkable. Instead of their being dull and depressed, prices have gone ahead. Business quickened up, and the removal of uncertainty, together with the rapid manner in which the Election is to be conducted, helped to stimulate activity all round the House. Widely different opinions and prophecies are expressed as to what is likely to prove the issue of the election. According to the dealings that are taking place every day in "Labour Seats"—the previous transactions in Majorities are not to be repeated this time—the general anticipation is that the Labour Party will come back with a slight increase in the number of its representatives. Should this prove to be the case, and the Labour Party remains in an indeterminate position, the political situation will continue practically the same as before. Labour in such circumstances would not be likely to have the opportunity for doing anything drastic either financially or otherwise. Such is the argument which is heard in the Stock Exchange to justify the firmness of prices and the greater feeling of confidence which now prevail.

Holders of electricity supply shares are watching the political issue with a certain degree of anxiety. According to report, the question of London's electricity supply was shelved by the Government until the end of this month for the express purpose of bringing into harmony certain conflicting elements that prevailed in the Party in connection with this particular point. It is said that the Labour Party was anything but unanimous as to the line upon which London's electric future should be directed. How far agreement is likely to be reached amongst discordant counsels, with an election falling due on the day when the Electricity Bills were to have come before Parliament, is a matter for discussion.

Meanwhile, prices are inclined to be dull, owing to the vagueness of the outlook. London Electrics are lower at 30s. City Lights and County ordinary have both fallen to 43s. 9d. These are the only quotable falls in the London group, but the market is what the Stock Exchange calls "tender." Edmundsons at 5½ are ¼ up, thanks to the proposal to replace £2 per share capital, making the shares £5 paid, and to split these into £1 shares. Amongst provincial shares, Newcastle ordinary went back to their par price of 20s. Bournemouth and Poole, however, continue strong, and the old ordinary have hardened to 53s., the new being about eighteenpence lower. Bromley (Kent) ordinary are quoted 33s. 6d. middle, but have not changed hands for three weeks. Clyde Valley ordinary hold their price at 27s. 6d. and Lancashire ordinary at 24s. 6d. The last-named company's 7 per cent. participating preference have been dealt in fairly frequently on the basis of 27s. 6d. Oxfords keep at £5 middle, the last bargain in them having been marked, at 98s. 9d., three months ago, while the preference, it may be remarked incidentally, have not changed hands since November 5th last year, when a transaction was recorded at 3¾. Yorkshire ordinary are hard at 26s. 6d., and the preference, nominally 23s., can probably be bought at a little under this middle price. Tees 6 per cent. debenture has advanced to 101.

The most dramatic movement in our list this week is a rise of 2¼ in Metropolitan ordinary, the price spurting to 76¼ upon buying that was possibly due as much to the bears as to genuine investment. The fall to 74 afforded, however, an opportunity to purchase for people who had been on the lookout for a chance to pick up stock that many consider to be worth 80, less on its own merits than on the hope that the company may be taken over by one of its bigger brothers. Districts hardened in sympathy to 49¼, the Underground issues remaining unchanged. East Londons are steady at 5. It is reasonably hoped that the stock will be taken over at 5½. Home Rails all round are better on the idea that, with a narrow margin of power in the new House of Commons, the Labour Party is not likely to proceed with nationalisation of the Home Railway companies, a plank in their programme which, it may be recalled, was considerably more prominent in last year's election than it is in the present campaign.

The long rises in Mexican utility stocks and shares were temporarily checked by a little profit-taking in Mexican Light and Power preferred, where the price shed a couple of points to 56 before recovering to 59. The 5 per cent. first mortgage bonds eased off to 67. Mexico Tramway sixes further advanced to 55, and the company's fives held their advance at 73. Brazilian Tractions have been less spectacular this week than of late, and at 57½ show a modest reaction. The preferred are better, however, at 98¼. British Columbia stocks are firm, and there is little change in the London transport issues. Amongst these latter it is worth mentioning that London United Tramways preference strengthened to 5s. A general tip went round that the shares were right to buy when the price stood about 6d. lower; buyers followed it up, there being some very vague impression that the company may return to the dividend-paying stage before long. This does not seem to be highly probable. Great things are hoped from the Traffic Bill, and the amelioration of the problems that have been for several years past—more particularly since the active advent of the pirate 'bus—a constant source of anxiety to those who are called upon to handle them. A bargain was done in the company's ordinary shares at 1½d., on the 3rd of this month. Bath Tramways preferred ordinary strengthened to 4s. 6d. British Automobile Traction debenture, now £55 paid, stands at 3½ discount. It came out at 95. The 8 per cent. preference shares change hands occasionally about 23s. 3d.

Few changes have occurred in the cable market. Eastern Extensions and Eastern Telegraph ordinary went ex dividend last week, and the deductions make the prices look cheap, but this has failed to bring in fresh buyers. United River Plate Telephones are 1/16 harder. In the wireless market, Radios, after their recent breathless rise, fell back to 5¼, and the preferred are slightly lower at 10¼. Canadian Marconi, however, are a better market at 7s. 6d. International Automatic Telephones rose to 24s. 6d., after the closing of the subscription lists for the new shares, offered at 20s. 6d. No change has occurred in Automatic Telephones.

General Electric preference weakened to 22s. 3d., and English Electrics at 18s. 3d. are 6d. lower. Electric Constructions also gave way, in their case to 27s. 6d. On the other hand, Callender's at 56s. 3d. have started to recover after their recent dulness. Edisons are 6d. to the good at 6s. There is some talk now of a substantial increase in the previously-paid 7½ per cent. dividend, some of the optimists going for 15 per cent. The rubber market is more robust, in sympathy with the price of the produce, again higher at 1s. 4d. per lb. The German loan is now out, and the advance fears expressed of the competition which this money will enable Germany to bring to bear against the British iron and steel industry have given way to a more composed feeling, with the result that prices of the leading descriptions are better. Babcock & Wilcox are unaltered at 46s. 9d.; most of the improvements are meagre, but the tendency of the market is a good deal harder than it was a month ago.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Dividend. 1923.	Dividend. 1923.	Price Oct. 15, 1924.	Rise or fall.	Yield. p.c.
Brompton Ordinary	1	12	10	87/-	—	*£5 8 1
Charing Cross Ordinary	1	14	14½	2⅞	—	7 3 0
do. do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	10	12	86/3	—	6 12 7
City of London	1	15	15	42/9	— ⅛	6 17 0
do. do. 6 % Pref. ...	1	6	6	23/-	—	5 2 2
County of London	1	10	15	42/9	—1/3	6 17 0
do. do. 6 % Pref. ...	1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	5	7	7	5½	+ ¼	4 0 0
do. 6 % Pref.	5	6	6	5½	—	5 9 1
Kensington Ordinary	5	13	14	9½	—	7 11 4
London Electric	1	10	10	30/-	—6d.	6 13 4
do. do. 6 % Pref. ...	5	6	6	5½	—	5 14 3
Metropolitan	1	8½	10	1⅝	— ⅛	6 3 1
do. 4½ % Pref.	1	4½	4½	17/6	+6d.	5 2 10
Newcastle-on-Tyne Ordinary ...	1	2½	6	1	—9d.	6 0 0
do. 5 % Pref. ...	1	5	5	17/-	—	5 17 8
do. 7 % Pref. ...	1	7	7	26/-	—	5 12 0
Notting Hill 6 % Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6 % Pref. ...	1	6	6	1½	—	5 6 8
Urban Ordinary	1	—	4	19/3	—	4 4 8
do 6 % Pref. ...	1	5	6	1	—	6 0 0
St. James' and Pall Mall ...	5	14½	17½	12½	—	7 4 5
South London	1	11	15	43/3	—	6 18 7
South Metropolitan Pref. ...		7	7	1½	—	5 12 0
Westminster Ordinary	5	12	15	10	—	7 10 0
Whitehall Elec. Invst. 7½ % Pref.	1	7½	7½	19/-	—	7 18 0

Home Rails.

Central London Ord.	Assented	Stock	4	4	70	—	5 14 2
Metropolitan	,,	3½	4	70½	+2½	5 4 7
do. District	,,	3	3½	49½	+ ½	7 1 5
Underground Electric	Ordinary	10	Nil	Nil	2⅜	—	Nil
do. do.	"A" ...	1	Nil	Nil	7/6	—	Nil
do. do.	Income	Bonds	5	5	96	—	*6 5 0

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	101½	—	5 14 10
do. Def.	,,	1½	1½	23⅜	—	6 6 4
Chile Telephone	5	6	6	5½	—	5 9 1
Cuba Sub. Ord.	10	7	7	7	—	10 0 0
Eastern Extension...	10	10	10	16xd	—	6 5 0
Eastern Tel. Ord.	Stock	10	10	160½xd	—	6 4 6
Globe Tel. and T. Ord.	10	10	10	17½	—	5 16 9
do. do. Pref. ...	10	6	6	11½	—	5 6 8
Great Northern Tel.	10	24	25	20½	—	7 9 2
Indo-European	25	7	7	32½	—	*5 6 1
Marconi	1	15	10	1⅜	—	6 3 1
Oriental Telephone Ord.... ...	1	12	12	1⅞	—	*6 12 7
United R. Plate Tel.	5	8	8	6⅛	+ ⅛	*5 15 6
West India & Panama	10	Nil	Nil	1/-	—	Nil
Western Telegraph	10	10	10	15⅜	—	6 6 1

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref....	5	12½	5½	8⅜	—	8 3 0
do. do. 2nd Pref. ...	5	5½	6	3⅛	—	9 4 2
do. do. 5% Deb. ...	Stock	5	5	73½	—	6 16
British Electric Traction Ord....	,,	5	6	94½	—	6 7 0
do. do 6% Pref. ...	,,	6	6	109½	—	5 18 3
Brazil Traction	100	4	4	57½	— ½	6 19 0
Brit. Columbia Elec. Ry. Pce.	Stock	5	5	87½	—	5 14 3
do. do. Preferred	,,	5	9/-	86½	—	*5 12 6
do. do. Deferred	,,	8	129/5	105½	—	*6 3 3
do. do. Deb.	,,	4½	4½	81½	—	5 4 4
Lond. & Sub. Trac. 5 % Pref. ...	1	5	2½	8/-	—	6 5 0
London United Tram. Deb. ...	Stock	4	4	55½	—	7 4 2
Mexico Trams. 5% Bonds ...	—	Nil	5	73	—	6 17 0
do 6% Bonds ...	—	Nil	Nil	55	+2	Nil
Mexican Light	Common ...	100	Nil	Nil	25	—	Nil
do.	Pref.	100	Nil	Nil	59	+1	Nil
do.	1st Bonds ...	—	5	5	67	—1	7 9 3

Manufacturing Companies.

Babcock & Wilcox...	1	20	12	46/9	—	a5 2 7
British Aluminium Ord.... ...	1	5	5	23/9xd	—	4 4 3
British Insulated Ord.	1	15	15	56/3	—	5 6 9
Callenders	1	15	15	58/3	+ ⅛	5 6 9
do. 6½ Pref....	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	5	Nil	⅛	—	8 17 10
Edison-Swan	4/-	7½	—	6/-	+6d.	5 0 0
do. ,, 5% Deb.	Stock	5	5	71½	—	6 19 10
Electric Construction	1	10	10	1⅜	— ⅛	7 5 6
English Electric	1	5	5	16/3	—6d.	5 19 5
do. do. Pref.	1	6	6	19/6	—	6 3 1
Gen. Elec. Pref.	1	6½	6½	22/3	—9d.	5 16 10
do. Ord.	1	5	5	17/9	—	5 12 8
Henley	1	15	15	55/-	—	5 9 1
do. 4½ Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	10	5	16/3	—	*6 3 1
Met.-Vickers Pref....	5	5	5	2⅜	—	6 14 9
Siemens Ord.	1	5	—	1	—	5 0 0
Telegraph Con.	15	20	20	15	+ ½	*4 16 2

* Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.	Price Oct. 14.	Fortnight's Inc. or dec.
a Acid, Oxalic ... ... per lb.	5½d.	...
a Ammoniac, Sal ... ... per ton	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax	£25	...
a Copper Sulphate ... ... ,,	£25 10s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a ,, Perchlorate ... ... ,,	4½d.	...
a Shellac ... ... per cwt.	£15 15s.	...
a Sulphur, Sublimed Flowers ... ,,	£7 15s.	...
a ,, Roll ... ... ,,	£7 15s.	...
a Soda, Chlorate ... ... per lb.	3d.	...
a ,, Crystals ... ... per ton	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	4½d.	...
METALS, &c.		
b Aluminium, Ingots ... ... per ton	£125 to £130	...
b ,, Wire ... ... per lb.	1/9 to 2/6*	...
b ,, Sheet ... ... ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... ... per ton net	£216	...
Grade II ... ... ,, ,,	£156	...
Grade III ... ... ,, ,,	£90	...
c Brass (rolled metal 2" to 12" basis) per lb.	9½d.	½d. dec.
c ,, Tubes (solid drawn) ... ,,	11½ to 1/-	...
c ,, Wire, basis ... ... ,,	9½d.	½d. dec.
c Copper Tubes (solid drawn) ... ,,	1/1	...
c ,, Bars (best selected) ... per ton	£92	...
c ,, Sheet ... ... ,,	£92	...
c ,, Rod ... ... ,,	£92	...
d ,, (Electrolytic) Bars ... ,,	£66 10s.	5/- inc.
d ,, ,, Sheets ... ,,	£143 10s.	...
d ,, ,, Wire Rods ,,	£76 10s.	5/- inc.
d ,, ,, H.C. Wire per lb.	9½d.	½d. inc.
f Ebonite Rod ... ... ,,	2/- to 3/6	...
f ,, Sheet ... ... ,,	2/- to 3/6	...
a German Silver Wire ... ... ,,	2/3	...
h Gutta-percha, fine ... ... ,,	8/6	...
h India-rubber, Para fine ... ... ,,	1/4½	1½d. inc.
Iron Pig (Cleveland Warrants) ... per ton.	£5 2s. to £5 2s. 6d.	...
i ,, Wire, galv. No. 8, P.O. qual. ,,	£25	...
g Lead, English Pig ... ... ,,	£36 5s.	£1 inc.
g Mercury ... ... per bot.	£11 15s. to £12	...
e Mica (in original cases) small ... per lb.	3d. to 8/-	...
e ,, ,, medium ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/3½	...
p ,, ,, drawn bars & rods ,,	1/8	...
p ,, ,, rolled strip & sheet ,,	1/3½	...
p ,, ,, wire ... ... ,,	1/9½	...
o Platinum ... ... per oz.	£26	...
d Silicium Bronze Wire ... ... per lb.	1/0½	...
r Steel, Magnet, in bars ... ... ,,	9d.	...
a Tin, Block (English) ... ... per ton.	£246 10s. to £247	£5 5s. inc.
a ,, Wire, Nos. 1 to 16 ... ... per lb.	3/11	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
j Richard Johnson & Nephew, Ltd.
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o Johnson, Matthey & Co., Ltd.
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Electricity on American Farms.—In order to find the economic method of supplying "electric service" to farms so that it will be beneficial both to the farmers and the power companies, experiments have been undertaken in the State of Minnesota by several co-operating agencies. Chief among them are the University of Minnesota, the Northern States Power Co., and a group of farmers living in the vicinity of Red Wing, a town in the south-eastern part of the State. Several electrical manufacturing concerns, such as the General Electric Co., of America, as well as manufacturers of farm machinery, are watching the undertaking. A trial transmission line, five miles in length, has been built out of Red Wing, and 18 farms have been connected up to it; after paying monthly fixed charges, the farmer is offered really low rates for energy, which have the effect of making his electricity cheaper per kWh the more energy he uses. The aim is to establish such rates as will invite the farmer to use energy in quantity, thereby insuring for himself cheap electricity with all the advantages that it gives him in his work and his home, and at the same time providing a profitable revenue for the power company, so that it becomes attractive for the latter to handle the business of supplying electricity for farms.

In other sections of the country, notably in Alabama, the whole question is also under investigation. In that State it is the Alabama Polytechnic Institute and the Alabama Power Co. which are co-operating to establish a basis upon which farm electrification may be carried out. There will be four lines in Alabama all told, of which one is thus far laid out in what is known as the Tennessee valley in the north. A second line will be built in the eastern part of the State, a third north of Birmingham, and a fourth in an area of large farms.

Regulations for the Electrical Equipment of Buildings.

A Contractor's Point of View.

(Communicated.)

THE details of the new rules and their effect on the industry have been during recent weeks a fruitful topic of conversation among those interested, and much has been written on the subject in the technical journals. On the whole, they are probably welcomed by the better-class contractors, whose aim is to carry out high-class work.

There is little in them that is startling, and still less that is not already done by the best firms. A general "tightening up" is, in the opinion of the writer, all for the good of the industry. There was a time, not so many years ago, when the advantages of electricity over gas for lighting and over steam engines and other prime movers for power were still subject matter for argument. Consequently, if the cost of electric installation work was unduly high, the balance weighed too heavily against the case for electricity, and the rival method was installed.

But now the battle is won, and the fight is no longer between rival illuminants or sources of power, but between the multitude of contractors whose services are offered for the execution of the work.

Where a house is to be decorated or a new one built, and electricity is available, who would dream of installing gas? In the case of the larger houses where there are no public supply mains, who would argue against the installation of a small plant? In an existing factory, unless conditions were very exceptional, who would put in a new steam or gas engine when the old one was no longer serviceable, if a public supply of electricity was available; and who would hesitate to equip a new factory for electric driving? If the new regulations tend, as the writer believes, to greater security and reliability, will the small percentage increase in the cost of the item for wiring, which in any case is usually a small percentage cost itself, affect the decision to utilise the services of electricity?

Think for a moment: A house costs £500 to build. The electric lighting will probably be done for £15, or 3 per cent. Another house costs £2,000 to build. Perhaps more elaborate fittings may be required, and the electric lighting may cost, say, £100, or 5 per cent. The cost of wiring a factory, including the power work, is usually a still smaller percentage. If, therefore, this is increased by insisting on safer and better methods by 10 per cent. or even 20 per cent., the latter figure is a very small percentage indeed of the total capital cost.

It has been argued that the small, inefficient wiring contractor will not in any case abide by the rules so far, at any rate, as he is able to evade them, and that for this reason a greater gap is made, than even now exists, between the prices tendered by him and by the honest and capable firm.

This may be, and no doubt is, perfectly true, and there are of course always plenty of people who compare tenders purely on the basis of price. But is it not so also in every other trade? There are always cheap articles for sale and plenty of people to buy them, and if they are satisfied to pay low prices and accept the risk of inferior goods or work, that is their trouble.

But there are also plenty of people who are prepared to pay the price for what they know to be good and reliable, and the new rules of the Institution, if carried out by a firm of repute, are a guarantee that they are getting what they ask for.

Here are one or two typical examples of installation work put out to tender:—

(1) The job that is offered to a few firms, which submit their own specifications.

If the customer accepts the lowest price and has no means of knowing what he is getting—except as the result of experience, when it is too late—he has only himself to blame if his experience is unfortunate. But if he selects the tender of a firm of repute and rejects prices which obviously must be too low to be reliable, he is probably taking the wisest course.

(2) The job that is offered to tender on a crude specification by an architect whose knowledge of electrical work is small, and who does not employ an electrical engineer to supervise the execution of the contract.

The job probably is given to the lowest tenderer, and if it has been advertised prominently and a large number of prices have been submitted, the firm that gets it has possibly made a mistake and will lose money. This is not written facetiously. It is certainly a fact that a very large percentage of the big advertised contracts are carried out at a loss. Now if there is no supervision, an unscrupulous contractor may gamble on the probability of his failure to carry out the Institution rules or some special points in the specification not being detected, and on the strength of this gets the order.

(3) The job offered on an engineer's specification with a certainty of rigid supervision.

In this case the rules will strengthen the engineer's hand, and should tend to lessen to some extent the extraordinary diversity of prices which usually occurs in public tenders.

But in case 2, if adherence to the Regulations is an item in the specification, it may act to some extent as a deterrent to the gambling spirit of the dishonest tenderer, for if non-compliance is detected, the culprit will be in a very uncomfortable legal position.

It must be admitted that there is to-day an enormous volume of electrical installation work to be done. True, there are very many people to do it. But still there is plenty for all, and enough indeed to justify prices being reasonably remunerative. In spite of this, it is regrettable that many contractors are still cutting prices to an absurd extent, and anything which tends, as the new Regulations should tend, if proper precautions are taken to see that they are carried out, to raise the standard of work must inevitably be to the advantage of all concerned.

At present, unfortunately, it does not appear to be anybody's business to enforce the Rules. The supply authorities have very limited powers, and in the absence of skilled inspection on behalf of the customer, much bad work will continue to be carried out.

There is one other aspect of the matter which is of interest. The rules call for the use of certain accessories which at present are not in universal use, and which will replace others of which contractors, factors, and manufacturers hold large stocks.

Take, for instance, porcelain cut-outs with terminals for the fuse wire, or "channel type" fuse distribution boards. The former should have been condemned long ago, and the latter are at any rate rightly condemned now. But since they have been tolerated so long, they must be accepted for a little longer, until existing stocks are exhausted.

Who is to give a ruling on this very important point, and who is to say to what extent stocks may be used up?

The Factories Bill, 1924.

As stated in our leading article of last week, in order to fully appreciate the effect of the Factories Bill it is necessary to take it clause by clause. It may be of assistance to all connected with the electrical industry to make brief reference to the clauses that are most likely to affect them.

The attention of owners of smaller factories is particularly drawn to the clauses of the Bill, as they are more likely to be affected than the larger works.

It is proposed to repeal the whole of the existing Factory Acts, except the Employment of Women and Young Persons Act, 1920 (Part XIV, 142). For those vitally interested, in spite of the fact that the Bill is a voluminous document in 14 Parts and 143 Clauses, it is important that they should study every clause, and too much reliance should not be put on the White Paper (Cmd. 2159) issued by the Government as a brief explanation of the changes in the law as this does not cover the new provisions of the Bill or important alterations to existing law.

We will confine ourselves to clauses affecting factories engaged in engineering and electricity industry, and building operations.

Part I.—General Provisions for Health.

The only changes here are Clause 2:—

Removal of Dust—Cl. 2.

(*a*) All accumulations of dirt and refuse shall be removed daily from the workrooms, staircases, and passages; and

(*b*) The floor of every workroom shall be thoroughly cleansed, at least once in every week, at a time when work is not going on in the room, and

partitions in addition to the inside walls, ceilings, tops of rooms, &c., if they have a smooth impervious surface, are to be washed with hot water and soap, at least once every period of 14 months.

These clauses are all to the good. No doubt clean workshops as a rule mean good work and satisfied employés. A little difficulty may arise in connection with cleaning the rooms when work is not going on, and, in some places, in view of the fact that women cannot be employed on Sundays. (Clause 76.)

Space Per Employé.—Clause 3 increases the minimum space per employé from 250 to 400 cu. ft., and also lays down that no space more than 14 ft. from the floor can be taken into account. This change is certainly not serious to modern workshops, but may affect old workrooms, in which workpeople are employed close together. Rooms less than 12 ft. high and having workpeople close together at a bench with a gangway between benches would probably be unable to employ the maximum number of hands that could be accommodated on the floor space.

Temperature of Workrooms.—Clause 4 demands that reasonable temperature should be secured during the whole time work is going on, the temperature to be not less than 60 deg. F.; where sitting work is done, a thermometer is to be hung in the room and kept in working order. The Secretary of State may also, by special order, prescribe a standard of reasonable temperature for factories or parts of factories. Here again, generally speaking, the bigger works are not affected, except that it may be necessary for them to take special steps to warm up their factories in good time before the works start after the week end or holiday stoppage. This, however, may not be altogether to their disadvantage as it is well known that in some works employés spend more time in the winter in endeavouring to keep themselves warm than in working, and the increased production may easily balance any increased cost. In smaller factories their existing heating arrangements may not enable them to comply with these regulations, and they may be involved in the expense of putting in hot water radiators, or some other satisfactory method of heating.

Ventilation.—In Clause 5, dealing with ventilation, there is no change from the 1901 Act.

Lighting.—Under Clause 6, for the first time, the control of lighting is brought within the scope of Factory Acts. It is understood the reason why this has been embodied is not so much the effect of lighting on the workers' eyes, but rather to help unenlightened employers to realise the value of efficient lighting towards production, by in some cases decreased lighting, in other cases increased lighting. It may compel some employers, even in the electrical industry, to improve their lighting, and so involve manufacturers in expense, but the industry, as a whole, will not be much affected, as up-to-date employers see that lighting is good. Anyhow, from an electrical contractor's point of view improvement in lighting conditions may mean an increase in business.

Sanitary Conveniences—Cl. 7, 8, 9, and 10.—In connection with the drainage of floors, and sanitary conveniences, there is no appreciable change from the previous Act.

Clause 9 limits the responsibility of the District Council for enforcing the provisions as to cleanliness, overcrowding, temperature, ventilation, &c., to all factories where mechanical power is not used which form part of a dwelling house or shop only. All other factories will automatically come under the Factory Inspectors unless the Secretary of State extends the District Council's powers in this direction.

Clauses 10 and 11 do not affect the manufacturer, but only prescribe the obligations of District Councils.

Medical Supervision of Employés.—Clause 12 is an entirely new feature, in so far that where, in view of the amount of sickness, the Secretary of State considers that a medical supervision of workers may be an advantage to secure the health of the persons employed therein, he may, by order, require the occupier to provide medical supervision. This clause should not be taken too seriously. In the United States in quite a number of factories both doctors and dentists are either attached to the staff or attend daily to supervise the health of the employés. The employers express the opinion that their production has been better maintained since the introduction of these special medical arrangements.

Part II.—Safety Devices.

Most employers will agree with the provision of proper safety devices, which they would wish to install in their own interest. Generally speaking, the clauses under this heading, if interpreted by the Inspector in a reasonable manner, need not be unduly onerous especially when one considers that the guarding and protection of machinery has a tendency to minimise the claims for compensation and in view of present legislation with regard to compensation there is every reason why the Act should compel workmen under penalty to observe these rules as well as the employer. In Clause 111 reference is made to the employé, but the provisions themselves are not sufficient. There are classes of machinery with which it may be difficult to carry out the letter of the clauses; for instance, according to Clause 14 "efficient devices are to be provided in every room where work is carried on, to stop promptly the transmission of machinery in that place." In the first place, what exactly is meant by "stop promptly." For example, a high speed motor or shaft having a number of flywheel pulleys of high inertia, such as pulleys of stamping presses, may run for a considerable time before it can be brought to rest, due to flywheel action, and it may be very difficult to make arrangements to stop it promptly.

Belts.—In Clause 14 (4) it is prohibited to allow a belt not in use to ride on a revolving shaft. No doubt accidents have occurred on account of this, but it should not be difficult in most cases to arrange to support the belt so that it does not rest on the shaft.

Automatic Safety Devices.—Clause 15 (3) is a very objectionable one. A machine is not considered securely fenced unless it is fitted with automatic safety devices if such are available. This may involve employers who have already spent considerable sums of money in fencing their machinery in further expense in fitting automatic devices, in spite of the fact that the fencing may be equal to, if not better than, an automatic device. Further, in many classes of machinery, such as stamping presses, automatic devices are available which are certainly not very efficient; under this clause the Factory Inspector may insist on these being fitted, and it is possible that a few months later a more efficient device may be invented, and the Inspector could order the removal of the less efficient device and the fitting of the new one, and so *ad infinitum*. It is not suggested for one moment that the Inspector would do this, but that he could do it. Therefore, the clause is objectionable, and should be deleted.

Guarding Work in Machine Tools.—Clause 15 (4) as it stands says: "Any part of any material or article which is dangerous while in motion in a machine shall be securely fenced." It is practically impossible to carry this out in the case of many classes of work held in machine tools, and this clause should be changed.

Clause 16—Protection of new machinery—deals with requirements to be fulfilled in the guarding of new machinery or machinery let on hire, and stipulates

(*a*) No set screws, bolts or keys on revolving parts shall project.

(*b*) All spur gearing shall be completely encased.

Whereas the desirability of (*a*) is recognised, at the same time it is not always necessary when the revolving parts are so situated that they are inaccessible to the operator. Similarly with the casing of gearings—there is no reason why gearing should be enclosed when it is well above the reach of operators. An exemption clause to cover cases similar to these would be sound.

Protecting Vessels Containing Dangerous Liquids.—Clause 17 deals with the protection of vessels containing corrosive and poisonous liquids. This seems reasonable.

Protection of Lifts and Hoists.—Clause 21 deals with hoists and lifts, and provides that a substantial enclosure to a height of 6½ ft. with a door or gate not less than 6 ft. in height must be provided. This will involve works in which there are existing installations in additional expense, but in the case of new hoists makers can comply with the regulation in their designs. Special requirements with regard to existing lifts and hoists for raising and lowering persons may mean considerable structural alterations, for sub-section

(4) calls for double roping or chains, each of equal strength, and an efficient safety device to hold the lift in case of breakage of chains, ropes or attachments.

Sub-section (5) calls for every lift to be examined by a competent person every six months. It does not describe who the competent authority is to be, but a record of each examination is to be attached to the general register.

Sub-section (6) covers regulations in connection with teagles, a protecting door of 3½ ft. being called for and a hand-grip on each side of the door jambs. This door, however, can be opened while lowering or hoisting, but must be closed at all other times.

Chains, Ropes, and Cranes.—Clause 22 provides for the safe use of chains, ropes, and slings, and includes provision of a table showing the safe working loads of such chains or slings (at different angles of the legs in the case of multiple slings). The table is to be posted in the stores in which chains, ropes, or slings are kept, and in a prominent position in the building. This will present no difficulties to large works, many of which already have such tables, but the provision of them in smaller works which have not the technical staff to deal with them presents some difficulty. Tables prepared by Government departments should be available for purchase by this class of employer.

Every chain, rope or sling has to be examined at such intervals as the Secretary of State may direct by special order. Compulsory annealing of chains and chain slings is dealt with in (*d*), and (*e*) calls for a register in the prescribed form, in which records in connection with chains, ropes, and slings are to be kept.

Maintenance of Passages and Stairs (Clause 23).—This calls for the efficient maintenance of passages and stairs, including provision of substantial handrails and the fencing of holes and openings in floors.

Safe Means of Access (Clause 24).—This states that persons shall not be employed or work at any place which is more than 12 ft. from the ground unless it affords a secure foothold or handhold, or adequate means of fencing, &c., to ensure safety. The chief difficulty which will arise here is in connection with maintenance and repair work when men have to get up on to roofs, crane tracks, &c. It will be necessary to provide for the employment of this class of man without having to fulfil the provisions in this clause.

Precautions in Places where Dangerous Fumes Accumulate (Clause 25).—Although new, there seems nothing to take particular exception to, but it is to be particularly noted that suitable breathing apparatus and oxygen reviving apparatus have to be provided so as to be readily accessible, and men trained and practised in the use of such apparatus are to be available.

Steam Boilers, &c. (Clause 26).—Although there are a number of new clauses, these seem to involve nothing more than the ordinary present standard practice. Examination is specially called for, but this is generally already covered by insurance companies' inspection.

Steam Receivers (Clause 27).—This calls for special safety devices for steam receivers, including a record of the dates of examinations, &c.

Exceptions as to Steam Boilers and Receivers (Clause 28).—This gives authority to the chief Government inspector to exempt the types of steam boilers or receivers to which the provisions of the previous two clauses cannot be reasonably applied.

Compressed Air Receivers (Clause 29).—This brings air-compressing plant, including receivers, within the regulations for safety fittings examination and recording in the prescribed form.

Means of Escape in Case of Fire (Clause 30).—This covers the regulations in connection with means of escape in case of fire, including the obtaining of the certificate of satisfaction by the district council for all factories and revision after extension. Under Clause 31 the Secretary of State may make regulations as to means of escape in case of fire, the appliances to be supervised by district councils.

Safety Provisions in Case of Fire (Clause 32).—The chief feature in this is the new regulation in connection with the equipment of fire alarm signals in any building forming part of a factory where more than 20 persons are employed above the ground floor or where explosive or highly inflammable material is stored. In addition, at least once every three months fire drill for all occupants shall take place.

Whereas the provisions for firm alarm will probably be fulfilled by installing a bell, the continuous expense and disorganisation created by fire drill practice every three months seems to be unnecessary in most factories in which 20 people are employed above the ground floor, although probably desirable in the case of those in which explosive materials are used.

Further Provisions as to Fire Precautions (Clause 33).—This deals with the construction of new factories in which all metal girders, beams, and supporting columns have to be encased in brick, concrete, or similar material, and wherever practicable all hoist ways shall be completely encased with fire-resisting material.

Clause 37 gives power to the factory inspector to give notice in writing to the occupier of any factory in which any work can be carried on in a dangerous manner, to call upon him to remedy the danger, which he is compelled to do unless he sends his objection in writing to the chief inspector, who may submit the matter for decision to a person appointed by the judge of a county court having jurisdiction where the factory is situated.

(To be continued.)

Scientific and Industrial Research.

THE Report of the Committee of the Privy Council for Scientific and Industrial Research for the year 1923-24 (Cmd. 2223; H.M. Stationery Office, price 3s. net+postage), states that the expenditure for the current year was estimated at £328,281 as compared with £276,863 during the past year. Personal inquiries have been conducted in connection with the research associations which are approaching the end of their grant periods, and arrangements for the future have been made with them. In many cases a further grant has been offered for a period of years, to enable the industry concerned to establish its research association on a self-supporting and permanent basis. Save in one instance—the scientific instrument industry—the offer of further grant aid has been on a rapidly diminishing scale. It is held that research associations must sooner or later look solely to the industries they represent for their maintenance, and it has been made clear in the new contracts that upon their expiration no further financial assistance can be looked for. The income of the associations from other sources must rise so that a minimum effective expenditure is ensured throughout the period of the contract. A new condition of grant empowers the Department to communicate any report of an association to the boards and committees of the Department, or to another Department of H.M. Government, for their confidential information.

It is the opinion of the Advisory Council that the scheme of co-operative research which led to the establishment of these associations promises to be a marked success. It has had the enthusiastic support of the more far-sighted leaders of industry, and scientific opinion has come to realise the value of co-operative research to the majority of the manufacturing industries of this country.

The Government has endorsed the view that it is impossible to exaggerate the importance of doing everything possible to promote research into the proper utilisation of coal. Proposals recommended in the Advisory Council's report consist of the more rapid development of the chemical and physical survey of the coal seams in this country, and the conduct of tests, under special conditions, at the cost of the State, of any promising plant or process for the low-temperature carbonisation of coal. The expansion of the Survey will involve the establishment of further local committees on which the mining interests as well as technical experts will be represented. The tests of new carbonising plant or processes will be conducted under the supervision of the Fuel Research staff of the Department.

The Treasury has considered the recommendations contained in the report of the Inter-departmental Committee on Patents, and instructions have been issued dealing with the exploitation of inventions made by Government servants. Every invention is to be referred to the Board of Trade for advice on its commercial exploitation, but the Department in which the invention originated is to be responsible for making all the necessary arrangements. The Treasury recognises that, in view of the large amount of research now being undertaken at the public expense by Government servants, discoveries may be made of which the full benefits should be secured for the State, subject of course to suitable awards being made to the inventors in proper cases.

During the past year 30 applications for patents have been filed by the Department, and three patents and patent applications have been abandoned or allowed to lapse. The new applications include six relating to a process for the protection of aluminium against corrosion by producing a film of oxide on the surface of the metal.

The expenditure of the National Physical Laboratory during 1923-24 amounted to £162,290. Of this sum £47,685 was provided from fees for tests and special investigations for outside bodies, £26,602 from repayments by the Service Departments for work undertaken directly for them, and £9,068 for three programmes of investigation of which the cost was met from special research funds and the interest of the Million Fund.

The expenditure on the work of the Fuel Research Board during 1923-24 amounted to £46,391. This sum includes the cost of work at the Station, £34,281, the cost of research carried out elsewhere than at the Station, £9,424, and other

expenditure £2,686. Receipts from testing fees and sales of by-products amounted to £3,978.

The number of industrial research associations in actual operation is 23. Grants to associations for the financial year 1923-24 amounted to £103,187, and the balance of the Million Fund remaining unexpended on March 31st, 1924, amounted to £618,318. A substantial part of this balance will be required to complete the payments of grants to associations which have not reached the end of their first grant periods and to meet the additional grants which have been promised to some of them. From the balance provision must also be made for any new research associations which may be formed hereafter.

The income derived from the interest of the unexpended balance of the Million Fund amounted during the year 1923-24 to £42,761. From this income, expenditure amounting to £10,065 was incurred on industrial research, and the surplus, £32,696, was appropriated in aid of the Vote of the Department, through which it was applied towards the cost of research work of value to industry generally, undertaken by the National Physical Laboratory, the Fuel Research Board and the Food Investigation Board.

During the year eight grants were made in aid of scientific investigations conducted by other bodies, at an expenditure of £3,424, of which £2,091 was met from the Vote of the Department, and £1,333 from the interest of the Million Fund. Also 291 grants were made to research workers and students-in-training. Of these, 244 were allowances to students to enable them to take advantage of the facilities for training in research afforded by various universities and colleges or other research institutions, 35 were personal grants to research workers to undertake independent research or to act as scientific assistants to other investigators, and 12 were personal grants to scientific workers to enable them to employ laboratory assistants or to purchase equipment. The total expenditure on these grants during the academic year 1923-24 is estimated at £41,000, as compared with £49,000 during the previous year. The expenditure during the financial year 1923-24, covering half of each of these academic years, was £45,303.

The expenditure of the Department on headquarters administration during the year was £33,367. The total expenditure of the Department was £515,382. This sum was made up of £274,297 from the Exchequer, £42,761 from the interest of the Million Fund, £103,187 from the capital of the Fund, and £85,251 from fees for tests and special investigations for outside bodies, and from other sources. The balance, amounting to £9,886, was met from the grant-in-aid of £39,500 voted by Parliament in 1921-22 for the unforeseen developments of researches undertaken by the Department. The balance of this grant-in-aid, amounting to £29,614, has been carried forward to 1924-25 and supplemented by the sum of £15,000 voted in the estimates of the Department for 1924-25.

The report of the Advisory Council to the Committee states that the reports of the visiting committees which have inquired into the scientific work of the associations, their business administration, and the economic conditions of the industries concerned, supply encouraging evidence of the soundness and utility of the scheme for co-operative research and of the advances which have been made, under the scheme, in the application of scientific research to the technical problems of industry. For the greater part, the research associations are fulfilling the hopes based on them at the initiation of the scheme, which as a whole has justified its inception. A large part of the success it has achieved is due to the enlightened and enthusiastic guidance which has been freely given on the governing bodies of the associations by the leaders of the industries in starting a new and untried movement.

Much attention has been paid to what may be called "foundational research"—namely, those investigations, the results of which are not of immediate industrial utility, but which are planned to expose the basic scientific facts that underlie a broad range of technical operations by extending our knowledge of the properties and behaviour of the materials in actual or potential use. In the majority of cases the visiting committees report that the amount of foundational work is most satisfactory, and in some instances they draw attention to the importance attached to it by the associations concerned. This is a most promising feature, for not only is it indicative of the enlightened attitude of the members of associations, but it suggests that the full benefits of the scheme of co-operative research are still to come. Foundational research, while essential to far-reaching technical advance, is, of necessity, slow in developing and in proving its value. To follow it is, in the first instance, an act of faith, and different industries naturally display, for historical and other reasons, different attitudes towards research of this character. The reports show that it is often uphill work for the far-seeing members of an industry to persuade their colleagues of its utility and significance, especially in times of trade depression. But, in time, all progressive industries will realise the importance of far-reaching research, and will come to regard membership of their research association in the same light as membership of their trade federation or local Chamber of Commerce.

In the majority of the associations which have so far been reviewed, research committees or panels have been found to play an active part in shaping their research policy. Several of the experts on the visiting committees have drawn attention to the educative effect of these research committees, and have pointed out that they will become powerful factors in the success of the associations. A well-balanced research committee includes industrial members, who may or may not have received scientific training, technical men engaged in the industry, the director of research, and possibly some of the members of his scientific staff. A problem can be reviewed by such a committee in its economic, technical and scientific aspects, prior to, and during, its attempted solution. The director of research is reminded of the existence of economic factors which may have escaped his notice, and the industrialist learns the scientific facts underlying the technical operations which he controls.

The case of the British Scientific Instrument Research Association called for special consideration. The report of the visiting committee on the scientific work, and on the practical results achieved, was highly favourable. The particular circumstances of this industry called for exceptional treatment because the advance of science is largely dependent upon the continued improvement of scientific instruments, and because the work of the Association is an important supplement to the research undertaken in the interests of national defence. On the recommendation of the Advisory Council, an offer has been made of a grant of £10,000 a year for each of the next five years, on the understanding that the industry raises during that period of time a total sum of £9,000 by annual sums rising from £1,500 in the first to £2,250 in the fifth year. The effective expenditure had been fixed at £11,500 for the first two years, rising thereafter by degrees to £12,250 in the fifth year. This offer made it necessary for the Department to exercise close control over the operations of the Association, and suitable conditions to this end have been framed and accepted.

A memorandum was submitted to the Council in October last by the Director of Fuel Research in which he drew attention to the need for the development of the work of the Board, the directions in which the need was most urgent, and the financial provision required for the development. An increase in the staff of the Fuel Research Station, and an extension of the physical and chemical survey of the national coal resources, were approved and the necessary financial provision was made in the estimates for the year 1924-25.

In June, 1924, the Secretary for Mines urged the desirability of a further expansion of the work of the Board as part of the Government plans for dealing with the general problems of industrial unemployment. A sum of from £20,000 to £30,000 per annum, in addition to the present expenditure of the Board, has been authorised for inclusion in future estimates.

For the past eight years, the Department has given financial support to the Institute of Metals for researches on the corrosion of condenser tubes and of aluminium, which have been of considerable value. The grant to the Institute is to cease, and the Chemistry Research Board is to make arrangements for research work to be carried out on the general study of the corrosion of metals.

The Illumination Research Committee has submitted a preliminary programme of research, which has been approved.

In the year under review 577 applications were received for grants to individual research workers and students-in-training, as against 668 in the previous year, and 291 awards were made as against 304. The standard of the work done by the students has been raised, and the reports which they made in September last marked a clear advance both in subject matter and in style.

The total expenditure on the grants to research workers and students during the year is estimated at £41,000, and, for the academic year 1924-25 provision has been made for an expenditure of £47,400.

Arrangements have been made with the authorities of the Royal Institution for the continuance in the Davy-Faraday Research Laboratory of Sir William Bragg's researches in the X-ray analysis of crystals. The Institution is bearing the cost of apparatus, workshop facilities and the like, during the current year, while the payments to Sir William Bragg's assistants are provided by a grant from the Department.

Coloured Telephotography.—Mr. George A. Taylor, president of the Association for Developing Wireless in Australia, New Zealand, and Fiji, recently delivered an address at Australia House, Strand, on recent wireless discoveries, and explained a process by which, it is claimed, coloured pictures of distant scenes can be transmitted. His apparatus was shown for the first time in Europe, and, according to the *Morning Post*, he explained that the picture is photographed through screens on to metal plates in the ordinary way for printing in their three primary colours, yellow, red and blue. Each plate is printed in black ink, and the print is enlarged, so that when acid is used on a metal plate it will leave deep etchings between the screen lines. The plate is then placed on a revolving cylinder with a needle in contact with the metal parts untouched by the acid, such contacts being transmitted by the "dot and dash" method, being picked up as in ordinary wireless reception by means of an ink-marker on a cylinder covered with paper. Each colour is transmitted as a black print, and the three pictures are then at the receiving station reprinted in their primary colours, thus reproducing the original picture.

Electric Fires.

Some New Designs for 1924-25.

(Concluded from page 554.)

Among the new designs produced by Messrs. May & Paddon, Ltd., are the fires illustrated in figs. 15 and 16. The first is a three-bar fire of handsome design with a case of stainless steel with a bright finish. The curved front acts as a reflector and concentrates the beam to a certain extent. Each bar is loaded to 1 kW, and one is permanently in circuit while each of the others is separately switched. The fire is 14 in. high, 16 in. wide, and 8 in. deep. The other fire (fig. 16) is of an easily portable nature, having a single 1-kW bar mounted in a dished rectangular reflector. The base and reflector have a polished brass finish, and the fire is 12 in. high, 12 in. wide, and 6 in. deep.

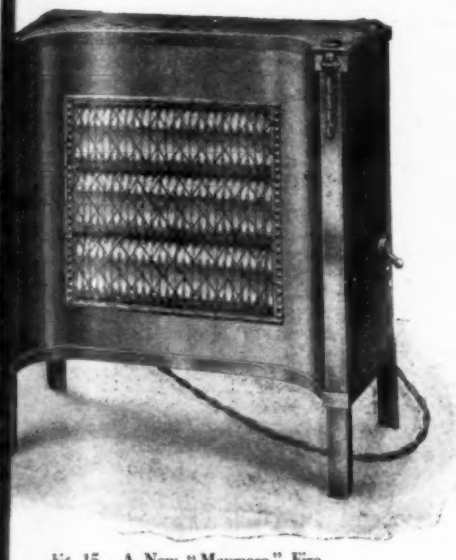

Fig. 15.—A New "Maymore" Fire

Fig. 16.—A "Maymore" Portable Fire.

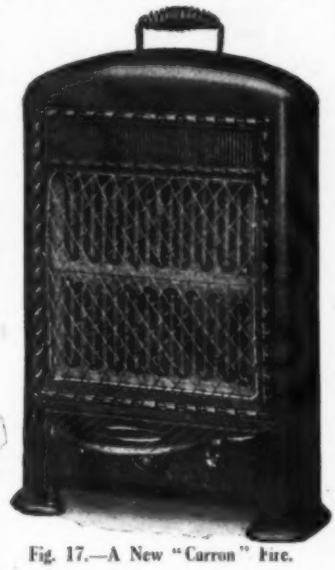

Fig. 17.—A New "Carron" Fire.

The "No. 587" and "No. 588" patterns are larger sizes of similar design with loadings of 2 and 3 kW respectively. Several kinds of finish are available. Most of the Jackson fires are designed for utility rather than for decorative purposes, which, after all, is the function of a fire. One or two patterns are produced on classic art lines, however.

In fig. 19 we illustrate one of the new "Magicoal" fires which Berry's Electric, Ltd., is putting forward. This is the "Firefly" model in which the imitation coal is placed behind bars in the front of the appliance. The usual "Magicoal" flickering-flame effect is produced in this. The elements have a loading of 3 kW and a three-heat control is fitted.

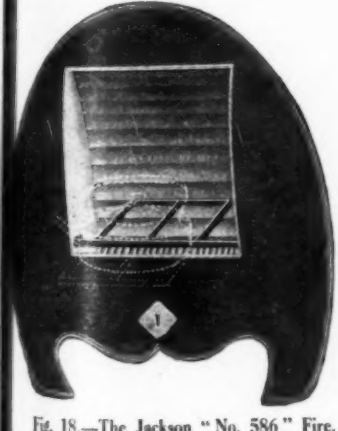

Fig. 18.—The Jackson "No. 586" Fire.

Fig. 19.—The Berry "Firefly" Fire.

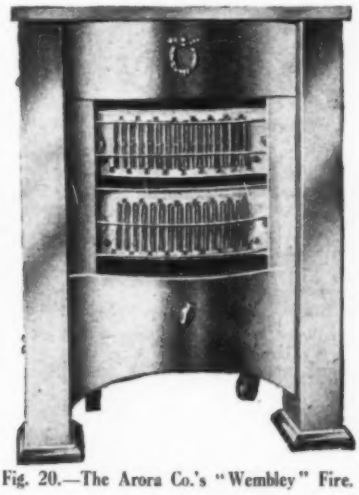

Fig. 20.—The Arora Co.'s "Wembley" Fire.

Fig. 17 illustrates one of the new designs brought out by Carron Company. This is a fire of plain outlines fitted with a wire handle for ease of carrying. It has two 1-kW bars, consisting of coiled nichrome wire on fireclay bases, each of which is separately switched. The fire is 14½ in. wide and 9½ in. high, and weighs 21 lb. It is produced in four finishes: Art black, armour bright, porcelain enamelled, and electro-bronze.

The Jackson Electric Stove Co., Ltd., is introducing several new designs, including that shown in fig. 18. This is the company's "No. 586" pattern, in which the elements are arranged horizontally below and in front of a curved reflector, which is divided into horizontal sections. A special feature of the fire is a swing-over trivet upon which a kettle of water can be placed and brought to boiling point very quickly. The height of the appliance is about 20 in., the width 17 in., and the "depth" 9½ in.; the loading is equivalent to 1.5 kW.

Other new models are the "Fly" flickering fire (3 kW), which dispenses with the imitation coal, and a "Jacobean" grate (3 kW), which retains the original "Magicoal" principles.

The Arora Co., of Loughborough, whose workshop fire was noticed in a recent issue, has sent us particulars of entirely new lines of sheet-metal fires which are finished in bright rustless steel; this metal has the appearance of "armour bright" without having to be polished. We illustrate in fig. 20 the "Wembley" two-bar fire, loaded to 1,500 watts, a similar pattern having three bars; the "Empire" fire is a more ornamental type, of very attractive appearance.

Electric Coaling Plant.—At a cost of £30,000, the London and North-Eastern Railway Co. is to erect an electrically-operated automatic coaling and sanding plant for the locomotives at Doncaster.

The Electrical Exports from Sweden.

The Figures for 1922 and 1923 Compared.

The following figures showing the exports from Sweden of electrical goods, machinery, and apparatus in 1923 are extracted from the recently-issued official trade statistics. The figures for 1922 have been added, together with notes of increases and decreases:—

	1922. Kr.	1923. Kr.	Inc. or dec. Kr.
Accumulators and parts thereof—			
Unmounted cells:			
Total exports ...	316,000	183,000	− 133,000
To Netherlands	22,000	3,000	− 19,000
,, Great Britain	166,000	146,000	− 20,000
,, United States	75,000	1,000	− 74,000
Accumulator plates:			
Total exports ...	434,000	282,000	− 152,000
To Denmark	9,000	60,000	+ 51,000
,, Netherlands	408,000	214,000	− 194,000
Cells and batteries:			
Total exports ...	265,000	571,000	+ 306,000
To Netherlands	1,000	22,000	+ 21,000
,, Great Britain	142,000	367,000	+ 225,000
Switchboards, fitted—			
Total exports ...	236,000	407,000	+ 171,000
To Denmark	5,000	48,000	+ 43,000
,, Spain	9,000	40,000	+ 31,000
,, British East Indies ...	9,000	130,000	+ 121,000
Wireless telegraph and telephone apparatus—			
Total exports ...	174,000	450,000	+ 276,000
To Norway	8,000	45,000	+ 37,000
,, Latvia	25,000	65,000	+ 40,000
,, Spain	20,000	26,000	+ 6,000
,, Switzerland	2,000	173,000	+ 171,000
Panels for telephone switchboards—			
Total exports ...	481,000	144,000	− 337,000
To Denmark	53,000	10,000	− 43,000
,, British South Africa ...	79,000	17,000	− 62,000
,, China	20,000	21,000	+ 1,000
Generators and motors, each weighing not more than 50 kg.—			
Total exports ...	2,482,000	4,437,000	+1,955,000
To Denmark	313,000	342,000	+ 29,000
,, Netherlands	352,000	609,000	+ 257,000
,, Belgium	456,000	759,000	+ 303,000
,, Great Britain	399,000	706,000	+ 307,000
,, France	458,000	797,000	+ 339,000
Generators and motors weighing 50 to 100 kg.—			
Total exports ...	259,000	339,000	+ 80,000
To Norway	25,000	41,000	+ 16,000
,, Finland	17,000	39,000	+ 22,000
,, Great Britain	62,000	66,000	+ 4,000
,, Australia	47,000	57,000	+ 10,000
Generators and motors weighing 100 to 500 kg.—			
Total exports ...	1,283,000	1,835,000	+ 552,000
To Norway	124,000	123,000	− 1,000
,, Finland	138,000	247,000	+ 109,000
,, Great Britain	183,000	490,000	+ 307,000
,, Spain	269,000	168,000	− 101,000
,, Australia	172,000	267,000	+ 95,000
Generators and motors, weighing 500 to 3,000 kg.—			
Total exports ...	1,499,000	1,769,000	+ 270,000
To Finland	121,000	204,000	+ 83,000
,, Belgium	95,000	135,000	+ 40,000
,, Great Britain	219,000	242,000	+ 23,000
,, Spain	262,000	292,000	+ 30,000
,, British East Indies ...	130,000	122,000	− 8,000
Generators and motors weighing more than 3,000 kg.—			
Total exports ...	3,047,000	1,700,000	−1,347,000
To Norway	1,334,000	250,000	−1,084,000
,, Denmark	106,000	202,000	+ 96,000
,, Finland	523,000	264,000	+ 259,000
,, Great Britain	165,000	125,000	− 40,000
,, Spain	379,000	242,000	− 137,000
Transformers, weighing 100 to 500 kg.—			
Total exports ...	486,000	507,000	+ 21,000
To Finland	166,000	92,000	− 74,000
,, Belgium	77,000	76,000	− 1,000
,, Spain	96,000	140,000	+ 44,000
,, Australia	42,000	58,000	+ 16,000
Transformers weighing 500 to 3,000 kg.—			
Total exports ...	604,000	620,000	+ 16,000
To Finland	73,000	102,000	+ 29,000
,, Belgium	145,000	78,000	− 67,000
,, Spain	104,000	140,000	+ 36,000
Transformers weighing more than 3,000 kg.—			
Total exports ...	980,000	1,308,000	+ 328,000
To Finland	190,000	80,000	− 110,000
,, Belgium	140,000	572,000	+ 432,000
,, Great Britain	52,000	81,000	+ 29,000
,, France	20,000	140,000	+ 120,000
,, Spain	—	135,000	+ 135,000
,, Australia	—	172,000	+ 172,000
Incandescent lamps: Metal filament—			
Total exports ...	123,000	181,000	+ 58,000
To Norway	9,000	24,000	+ 15,000
,, Denmark	17,000	11,000	− 6,000
,, Finland	37,000	90,000	+ 53,000
,, Australia	1,000	20,000	+ 19,000
Starting, regulating and reduction resistances, &c.—			
Total exports ...	700,000	531,000	− 169,000
To Finland	64,000	126,000	+ 62,000
,, Spain	77,000	70,000	− 7,000
,, Australia	39,000	68,000	+ 29,000
Stators, rotors, current collectors, magnet coils, &c., weighing each not more than 50 kg.—			
Total exports ...	92,000	73,000	− 19,000
To Norway	20,000	19,000	− 1,000
,, Denmark	19,000	9,000	− 10,000
,, Finland	4,000	11,000	+ 7,000
Oil break switches, hand-operated—			
Total exports ...	194,000	163,000	− 31,000
To Denmark	1,000	26,000	+ 25,000
,, Finland	78,000	50,000	− 28,000
,, Spain	29,000	38,000	+ 9,000
Switches, not specified—			
Total exports ...	78,000	101,000	+ 23,000
To Norway	21,000	26,000	+ 5,000
,, Finland	19,000	28,000	+ 9,000
,, Spain	12,000	12,000	—
Safety appliances, not specified—			
Total exports ...	1,071,000	676,000	− 395,000
To Netherlands	784,000	254,000	− 530,000
,, British South Africa ...	4,000	75,000	+ 71,000
,, Finland	46,000	28,000	− 18,000
,, Spain	94,000	69,000	− 25,000
,, Australia	5,000	34,000	+ 29,000
,, China	27,000	26,000	− 1,000
,, British East Indies ...	1,000	17,000	+ 16,000
Telephone apparatus, weighing less than 5 kg. per article—			
Total exports ...	565,000	1,202,000	+ 637,000
,, Netherlands	149,000	160,000	+ 11,000
,, Norway	96,000	121,000	+ 25,000
,, Mexico	50,000	135,000	+ 85,000
,, Spain	55,000	111,000	+ 56,000
,, China	23,000	79,000	+ 56,000
,, Finland	25,000	103,000	+ 78,000
,, Poland	4,000	330,000	+ 326,000
Ditto, weighing 5 kg. or more—			
Total exports ...	950,000	971,000	+ 21,000
To Finland	48,000	136,000	+ 88,000
,, Poland	2,000	66,000	+ 64,000
,, Portugal	108,000	66,000	− 42,000
,, British South Africa ...	105,000	84,000	− 21,000
,, China	214,000	223,000	+ 9,000
,, Australia	56,000	100,000	+ 44,000
Telegraph apparatus, telephone switches and switchboards and parts—			
Total exports ...	6,759,000	5,970,000	− 789,000
To Norway	112,000	225,000	+ 113,000
,, Finland	310,000	318,000	+ 8,000
,, Russia	1,719,000	514,000	−1,205,000
,, Poland	145,000	498,000	+ 353,000
,, Netherlands	2,431,000	2,235,000	− 196,000
,, British South Africa ...	249,000	372,000	+ 123,000
,, Mexico	182,000	591,000	+ 409,000
,, Australia	55,000	158,000	+ 103,000
,, China	56,000	132,000	+ 76,000
Cables and cords with sheath of lead or other metal; maximum diameter 25 mm.—			
Total exports ...	513,000	583,000	+ 70,000
To Poland	185,000	160,000	− 25,000
,, Germany	14,000	3,000	− 11,000
,, Netherlands	93,000	208,000	+ 115,000
Ditto, of greater diameter—			
Total exports ...	125,000	268,000	+ 143,000
To Poland	45,000	179,000	+ 134,000
,, Australia	—	29,000	+ 29,000
Wires and cables insulated by paper, asbestos or varnish; maximum thickness of wire 0.5 mm.—			
Total exports ...	305,000	596,000	+ 291,000
To Denmark	137,000	74,000	− 63,000
,, Great Britain	25,000	240,000	+ 215,000
Ditto, thickness of wire greater than 0.5 mm.—			
Total exports ...	260,000	333,000	+ 73,000
To Netherlands	81,000	134,000	+ 53,000

The Application of Electricity to Light Transport.

I.E.E. Western Centre: Chairman's Address.

MR. W. NAIRN, A.M.Inst.C.E., M.I.E.E., electrical engineer of the Bristol Tramways & Carriage Co., Ltd., chairman of the Western Centre of the Institution of Electrical Engineers, delivered his inaugural address at Bristol on October 6th, in the course of which he said, *inter alia*, that the tramway line from St. George to Old Market Street, in the City of Bristol, was amongst the first, having been built in 1895.

Tramway Experiments.

The object of using roller and ball bearings was, first, the saving of power and, secondly, labour saving in maintenance. The armatures and car axles of three tramcars in Bristol were equipped with ball and roller bearings, and one of the first points noticed in carrying out tests was that the percentage saving was much greater on level than on hilly routes. This was due to two factors: In descending hills with the brakes applied no saving in power took place, whilst in ascending hills the ratio of the friction current to the total current was small, and any saving in friction current resulted in a small percentage saving. There was a wide variation in the results obtained in different towns, but in Bristol the percentage saving in power on hilly routes was 6 per cent. and on the level routes 11 per cent. Roller bearings on a workshop shaft saved money all the time, whereas on a street car there were many periods when roller or ball bearings were a distinct disadvantage, *viz.*, when descending hills and accelerating. In Edinburgh, where there was the most modern tramway system, the magnetic track brake was used, acting only on the rails, but also capable of being applied by compressed air, which was obtained from an electrically-driven compressor on the car and driven from the trolley wire. Unfortunately regenerative control had not been a commercial success, due to the fact that the saving in power did not pay for the capital and maintenance charges of the regenerative equipment. In Bristol four cars were equipped with regenerative control, and tests showed a saving in power of less than 3 per cent. With the further cheapening of electricity, the future for regenerative control on either tramcars or railways was not very bright, and he made that statement whilst being fully alive to the fact that in America the latest railroad electrification schemes were all equipped for regeneration. A new overhead conductor which promised well was a cadmium-copper alloy which combined a conductivity of over 90 per cent. of Matthiessen's standard, with wearing qualities that approached those of the other alloys. For insulation, porcelain was gradually replacing the composition insulations introduced from America, whilst a committee appointed by the Municipal Tramways Association had standardised a complete line of fittings, and a standing committee had been appointed to consider suggested improvements. That committee was brought into existence on the suggestion of one of their own members, Mr. H. I. Rogers.

Petrol Vehicle Starters.

Passing to the pure petrol vehicle, the equipment of interest was the electric lighting, starting, and ignition outfits. No passenger car was fully equipped without a lighting and starting set, but the starting set was still omitted from most of the heavy petrol vehicles engaged on 'bus or commercial work, really a very difficult problem owing to the variable engine speed and the uncertainty of output. For example, a motor coach doing long day trips in summer would have an engine speed and period of running time ideal for charging the battery, which might not be required owing to the trips being run in daylight. The same chassis put on to winter duty as a 'bus would be continually stopping, so that the battery would not get properly charged, but it would nevertheless be called on to deal with the lighting of a saloon body with about eight additional lights. Having that continual variation in demand in mind, it was strange that the popular system of battery charging was the so-called constant-current method, which was inherently wrong, as the current passing to the battery should vary with the state of charge of the battery. That result could be obtained by the constant-potential method of charging, and the reason it had not been adopted was seemingly the inability of British manufacturers to make a practical constant-potential machine. A further advantage was that the lamps could be lit without the battery, whereas in the constant-current system the battery and dynamo were one unit, and if disconnected from one another, the lamps or the dynamo were likely to be burned out due to excess voltage. Constant-potential machines of foreign manufacture had been available for many years, and had recently been brought to a high state of perfection; the author considered it most unfortunate that the experience of the heavy electrical engineering firms with voltage regulators was not available to meet this competition.

Motor-car Ignition.

For ignition in motor vehicles, the magneto still held the field, the proportion of cars fitted with magnetos being 80 per cent. against 16 per cent. fitted with coil ignition; the remainder had dual ignition. Coil ignition made considerable headway until last year, but there was now a tendency to revert to the magneto. Coil ignition gave easy starting and perfectly satisfactory running if the battery was looked after, but electrical engineers had no right to expect the motor user to have to take regular specific gravity readings to find the state of charge of his battery, and it was the duty of engineers making lighting sets either to provide a constant-potential dynamo which would keep the battery charged automatically, or else invent some kind of dash-board indicator which would show the state of charge of the battery.

An Electrical Dynamometer.

There was little in the electrical equipment of the aeroplane which differed from motor-car practice. However, one matter was of special interest to electrical engineers. Air-cooled engines were usually tested for endurance and brake horse power by coupling them to a water brake and running them in an air current comparable with the flying conditions, an electric motor being coupled to the shaft for starting and running in. The fan supplying the air blast required about one half the horse power output of the engine, so that on a 100-h.p. engine test stand, 50 h.p. was continuously used in providing the blast and 100 h.p. was continuously wasted in the water brake.

With the smaller sizes of aeroplane engines, there was little to be said against that method, but with aeroplane engines developing 1,000 h.p., the problem was different. The Bristol Aeroplane Co. considered the problem carefully, and decided that the correct course to adopt was to make the test engine provide the power for the blast. The only method of doing so satisfactorily was by means of an electrical dynamometer, and that adopted was a 500-volt direct-current generator with the field mounted on trunnion bearings and kept from revolving by being attached to a spring balance which measured the torque of the engine; the speed of the engine was measured electrically by a small generator mounted on the end of the shaft and recording the revolutions on an instrument of the illuminated dial type. The engine to be tested was directly coupled to the dynamometer, which was also used for starting the engine and running it in. The fan for the blast was mounted at the end of the wind tunnel, and a storage battery and booster formed part of the equipment.

The method of operation was as follows:—Current was drawn from the battery to motor the dynamometer and revolve the engine, and also to run the fan for the blast. When the engine fired, the dynamometer generated and charged the battery and drove its own fan, the torque on the dynamometer being adjusted by varying the current passing into the battery, which was controlled by a regulator in the battery-booster field. The battery installed at Filton had 240 cells, and a capacity of 1,950 ampere-hours at the 10-hour rate. With that system a plentiful supply of power was available when required for operating the fans, and the output of the engines was not dissipated in heating water, but usefully converted into electrical energy.

Standardisation of Frequency.

They were justly proud of the part which electricity had played in the march of progress, and need not be unduly alarmed at the statistics which showed that the kWh used per head of the population in the large cities of this country were only about 200, against 700 in American cities. There was no comparison between the conditions. They had been reared on cheap coal, and were building up their electricity supply industry on strong and substantial British lines, only the best practice being retained. There was only one flaw in the whole structure, and that was the non-standardisation of frequencies. General experience called for 50 cycles, but it was difficult to see how the large systems operating at 25, 33⅓, and 40 cycles could possibly be changed over. The expense would now be so great that it could not be justified.

Patronage.

At the moment the electricity supply industry was embarrassed with a plurality of political patrons, patrons as defined by Dr. Johnson when he asked in his famous letter to Lord Chesterfield: "Is not a patron, my lord, one who looks with unconcern on a man struggling for life in the water, and when he has reached ground encumbers him with help?" The Labour patron proposed a national system based on public ownership and control. If that did not fructify, other patrons were ready with schemes which would probably include a Government grant to develop electricity supply in unremunerative areas, or to generate electricity by what were at present unremunerative methods. Such grants would be accompanied by a measure of Government control and, in the course of time, the industry would be nationalised. The author did not presume to express an opinion on the desirability, or otherwise, of nationalisation, but it was well for them to have their eyes wide open to what was going on round about them.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Sanco" Joint Box.

A new type of "universal" joint box for wiring systems has been put on the market by the Sun Electrical Co., Ltd., 118 & 120, Charing Cross Road, W.C.2. This, the "Sanco" joint box, is illustrated in fig. 1, and, as will be seen, has four outlets, any of which can be closed up by special stop pieces held in position by grub screws. These pieces have a further use; when reversed they can be used for the entry of cables up to twin 18 s.w.g., the plug being discarded. If the wires are above this size the whole stop piece can be thrown away and the plain openings used; these will accommodate cables

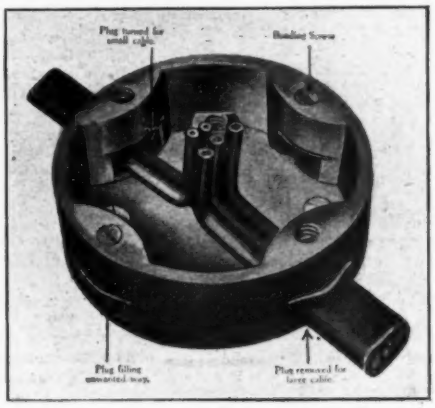

Fig. 1.—The "Sanco" Joint Box.

up to 3/.036 (three core). The retention of the stop piece gives an efficient earthing contact and prevents the grub screw from cutting into the lead of the cable. The box itself is a white-alloy die casting, and when used simply as a joint box it is provided with an oxydised copper cover. When employed in conjunction with ceiling roses, or other fittings, a wood pattress is provided. The wires can be simply soldered together, or the company's one-, two-, or three-way china connectors can be used.

The Philips Rectifier.

Carrying heavy accumulators to and from charging stations is a task which many would willingly dispense with. Simple apparatus that enables all electricity users to charge their batteries at home (on an alternating current supply) is the Philips rectifier, placed upon the market by Messrs. A. de Jong, 58, Southwark Street, London, S.E.1. This device is manufactured at Philips' Glowlampworks, Ltd., Eindhoven, Holland; it is strongly made, neat in appearance, practically noiseless, and consists of a transformer, a rectifying valve, and a resistance lamp. It is capable of charging from one to six cells with a current of 1.3 amp., and the total consumption of the rectifier when charging six cells amounts to about 500 watts. The filament glows at a low temperature so that it has a long life; it needs no attention while in operation, and should the supply be interrupted, the batteries cannot discharge themselves. The complete rectifier is only 7¾ in. high and 6¼ in. in diameter.

New Tumbler Switch and Switch-Plug.

From the General Accessories Co., Ltd., 125, High Holborn, W.C.1, we have received samples of a new quick-make and quick-break tumbler switch, and a plug for use in conjunction with a tumbler switch. The "Expreso" switch has

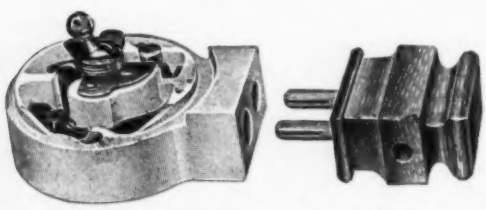

Fig. 2.—The "Expreso" Switch and Plug.

the dolly-bridge secured to the china base by means of large headed screws with a nut below the base to ensure proper attachment. The moving contact-maker (which is well insulated from the lever by mica washers) works on two small steel pinions, with shoulders screwed into the sides of the bridge. The spring is a helix of best quality piano wire, coppered to prevent rusting. The centre pin is made of brass, with a steel pinion through the centre, working on the end of the dolly. The contacts are of the double-leaf type, made of very hard and flexible copper, ensuring a large surface contact. A peg plate of brass is mounted on the top. The movement of the dolly gradually compresses the spring until the centre point is almost reached, when the existence of a "dead-centre" being impossible, the spring is released and snaps the contacts over.

The tumbler switch for use with a plug (fig. 2) is so arranged that when the plug is out a spring-loaded catch pulls the contacts out at every attempt to switch on. The insertion of the plug holds the spring in compression, and prevents the catch from acting. If the plug is withdrawn while the switch is on, the circuit is broken before the plug has left the sockets.

Porcelain Coil and Valve Holders.

With the object of reducing capacity effects between the connectors and improving insulation generally, porcelain coil mounts and valve holders, figs. 3 and 4, have been introduced by the Athol Engineering Co., of Cornet Street, Higher Broughton, Manchester. They are by no means fragile and the ease of insertion and removal in different coil-holders is noticeable; the plug is split on two diameters and is turned to a smaller diameter on the lower half, giving good springy electrical contact. The mount is neat in appearance and has high insulating properties with a minimum of distributed capacity between plug and socket. Convenience and economy result from their use on a wooden baseboard, and apart from

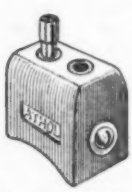

Fig. 3.—Porcelain Coil Mount.

Fig. 4.—Porcelain Valve Holder.

the feature of reversibility, the valve holder can not only be mounted on the front or the back of vertical or horizontal panels, but even on metal with perfect safety, and the size is about as usual.

The company's aerial-earthing plug is in three parts. The base is screwed to the window frame and the aerial and earth are connected to the terminals provided. The set is connected to an entirely separate plug so that when not in use it is entirely isolated. The third part is a plug which is used to short circuit or connect together the aerial and earth leads; it is secured to the base by a short length of chain so that it cannot be misplaced. Inside the base a spark gap is arranged so that if lightning occurs when reception is taking place the currents can be passed direct to earth without entering the set.

The "Kwikwire" Terminal.

The new sunk type tumbler switches introduced by Messrs. J. H. Tucker & Co., Ltd., King's Road, Tyseley, Birmingham, are equipped with a neat time and labour saving device—the "Kwikwire" terminal. The application of this terminal to the switches is illustrated in fig. 5. The device has an in-

Fig. 5.—Sunk Switches with "Kwikwire" Terminals.

sulating collar, surrounding and projecting well above the screw head, which prevents any possibility of contact with the cover of the box. Should the terminal not be pushed right "home" after wiring, the box cover will complete the operation by pressing on the collar. The other end of the terminal is a split pin which, not being subject to frequent withdrawal, is a very satisfactory method of connection.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Electric Cooking and Heating.

I was very much interested in Mr. A. E. Jepson's letter in your issue of October 3rd, and especially in his remarks on the subject of ventilation when using electric heating.

I cannot agree with your correspondent that the occasional opening and closing of doors provides sufficient ventilation in a room in which there is no flue or in which the flue has been closed up. The atmosphere in such a room is bound to become vitiated after a while, particularly if there are many occupants.

I quite fail to see the necessity for closing up the flue when an electric fire is used in an existing fireplace, provided that care is taken that the canopy is pushed in until the top of the fire is at least six inches in front of it. If this is done there can be very little, if any, direct loss of the convected heat, and the stale warm air from the room passes up the flue, maintaining a healthy atmosphere.

It must be remembered that whatever the form of heating used, ventilation must always entail a loss of heat, but electric heat is now quite cheap enough to suffer this loss in common with competitive methods.

In bedrooms there is not the slightest need for flues, as everyone sleeps with the windows open, or, at least, ought to do so.

Whilst on this subject, I should like to allude to the claims made concerning the ventilating properties of the gas-fire.

Ask any gas engineer his objections to electric heating, and he will reply: (*a*) That it is from three to five times dearer than gas, and (*b*) that it is a most unhealthy method of heating, as it does not assist the ventilation, whilst a gas-fire creates a draught up the chimney, changing the air several times an hour. Reason (*a*) is very easily refuted, provided that the price per unit is in the neighbourhood of 1d., but I have never seen the fallacy of reason (*b*) pointed out.

One well-known firm manufacturing gas-fires fitted with a double flue claims that its fires change the air in the room six times per hour. In the case of an average room of a capacity of 2,000 cu. ft., a gale of approximately 22 miles per hour through the cracks round the door is necessary to change the air six times an hour, if it is assumed that the crevices round the door have an area of 10 ft. × ¼ in.

The absurdity of this claim is obvious. Of course, if the door were left open, this rate of ventilation would probably be reached, but no one sits with the door wide open in cold weather.

I very much doubt whether the lighting of a gas-fire makes any appreciable difference to the normal draught up the flue, and maintain that it is this normal draught which carries away the fumes, and not the passage of the fumes which causes the draught.

A simple experiment which I have just carried out on a disused gas-fire confirms this view. A lighted cigarette placed upon a small stool was moved as near to the fireplace as was possible without the stream of smoke being carried up the chimney by the normal draught. The gas-fire was then lit and turned full on, and there was not the slightest deflection of the smoke towards the chimney, proving that the lighting of the gas-fire had not increased the ventilation to any appreciable extent. Moreover, under normal circumstances, all the fumes from a gas-fire are not carried away by the flue, otherwise the placing of a piece of rubber on the radiants of a lighted gas-fire would not, as it does, cause a smell of burning rubber in the room. The attitude of many gas engineers to this question of the relative hygienic values of electric *v.* gas heating is most inconsistent. They condemn the electric fire as being unhealthy, and the next minute they advocate flueless gas radiators for shops and school class-rooms.

The views of your readers on this important subject would be of interest, particularly if any of them could defend the gas-fire against the electric fire.

The hygiene of electric heating must be permanently established, so that any future attacks upon it will encounter nothing but disbelief.

October 4th, 1924. **Cuisinier.**

Radio Transformer Characteristics.

I have read the correspondence on this subject in your issues of September 26th and October 3rd. It seems to me, as one who has examined and tested most of the British transformers and who has also investigated the problem to some extent, that neither of your original correspondents, Messrs. Onslow and Coleman, is quite acquainted with the difficulties of the problem. Those who have investigated realise fully that the design of an intervalve transformer to give an exactly even amplification over all frequencies is an impossibility, and (as is usually the case in engineering design) the matter resolves itself into a compromise between various opposing characteristics.

Generally speaking, a close approach to even amplification is likely to involve a large quantity of fine wire, leading to excessive expense and fragility. If any attempt is made to secure cheapness of manufacture and robustness, it is probable that a certain amount of evenness of amplification must be sacrificed. The direction in which the compromise will tend must depend essentially upon the personal views of the manufacturer. Further, if a transformer is made to give a very even scale of amplification with certain valves, it by no means follows that it will give it with others.

In fact, one might quote as a simple analogy that a mirror galvanometer, while undoubtedly a magnificent instrument, would probably be not so useful for many purposes as a lineman's detector.

In one or two letters another make of transformer was mentioned, *viz.*, the Marconi Ideal. This is a magnificent instrument, but it is not claimed to be as universal in its application as the one originally in dispute. It is made in three types, each specially designed for certain work, and I have no doubt at all that the general public will probably find it easier to get reasonably good results with the transformer of Radio Instruments, Ltd., although the expert would perhaps find that it is possible to obtain better results under proper conditions with the Marconi. One is a universal instrument designed for general use, the other a specialised piece of apparatus designed for the skilled: each is equally good in its own field.

In another respect your two correspondents appear to the writer to have missed the mark. They are very anxious to defend the N.P.L. against alleged "exploiting" of its report, and are at great pains to point out that the N.P.L. tests anything. Perhaps they do not realise that the N.P.L., fully realising the value of its reports, actually issues in its "General regulations governing tests of instruments, &c.," instructions as to the exact conditions under which certificates may be published. As no protest has apparently been made by the Laboratory, it may be taken that the curve in question is published with its knowledge and consent.

It is in my view a most meritorious procedure on the part of the manufacturer: since every instrument is bound to be a compromise between efficiency and practical considerations, it is of the greatest advantage to the user to have an impartial statement, showing just what the instrument can do. With this in hand, the purchaser is in a position to use the apparatus to the best advantage.

London, *October 6th*, 1924. **P. K. Turner.**

[Our correspondent, we think, has put the case admirably. We welcome the publication of authenticated data such as Messrs. Radio Instruments, Ltd., have put forward; obviously they would not have published the curve if they had not been satisfied with it, and we believe they are the first makers to take this course. Publication invites criticism, and our correspondence columns have always been open for the free discussion of such matters, whether we agree with the views expressed or not, but we would suggest that comments should be broad-minded and practical, and should take into account not only the characteristics of an individual item but also those of the items associated with it. To suggest that a transformer which had a perfectly uniform characteristic curve for all frequencies would, when combined with valves, a receiver, and a horn, reproduce all frequencies without distortion, would be absurd.—Eds. Elec. Rev.]

A Modern Electric Flat.

Reading Mr. Sam Hall's letter in your issue of the 18th ult. makes me wonder why, if "The phenomenal progress which gas for heating and cooking is making, especially when compared with the insignificant progress of electrical heating and cooking, is a clear indication that the general public cannot be deceived all the time," he is so bitter about the progress which is being made in Hackney, "the City Electra."

I thank you, Sirs, for having yourselves answered Mr. Hall's silly remarks about Hackney's costs. Naturally I made sure of my costs being right before commencing to sell cheap "juice" for cooking. As a matter of fact, I couldn't stop the progress of Hackney electric cooking now, even if I tried. One might as well try to oppose the tide. It recommends itself.

Take, for instance, these results of practical everyday tests by consumers themselves, expressed in their own language:—

From a Poor Man: "Cooking by electricity is an entirely new thing to my wife. She has used it very freely during the past five weeks, and her experience is that it cooks meat better than gas, that the meat does not in the process of cooking lose so much in weight, and that on balance it is cheaper to use than gas, whilst it has the additional and supreme advantage that there are no fumes. She is charmed with the newer and better way. She likes it especially for cake and pastries, which have been light and delicious."

From a Fairly Well-to-do Man: "We are very pleased that we tried the electric cooker, and if the first quarter's charge is an average we shall be more than pleased. The absence of fumes, and in consequence, the hygienic kitchen for the maids, &c., is a big point. Many of our friends are greatly prejudiced against above, owing to wrong impressions."

From One Who Would Still Give Gas a Chance: "I think you will be pleased to hear that my wife is very satisfied with the cooker, and the account is less than when the cooking was done by gas. I was advised by one of the Gas Company's servants that my bill would be double, and by another that it would be three times as much. I have invited one of them to come and cook a dinner on the cooker and prove for herself that it is by far superior to gas cooking, but so far she has not *found time* to accept my offer."

From a Restaurateur: "We have pleasure in writing and informing you that our electrical apparatus installed some

months ago at our Stamford Hill depôt is giving us great satisfaction. The quality of the food cooked is a great improvement on gas cooking which we have had working in the restaurant for some years, and not only is the flavour of the food retained but there is a considerable saving in actual wastage which was caused by the shrinkage of the food in gas cooking. The public are the best judges in such matters, and we have evidence in every direction from our old customers that they very much appreciate the change to electric cooking, and as our trade in this restaurant increases, this again is testimony of improvement. The only point that does not compare favourably with gas cooking or stove cooking is the question of cost, as the amount is slightly in excess of what we previously paid, but this is more than counterbalanced by other conditions and we certainly should not go back to the old method."

I have not referred to heating. We don't worry much about it. It just sells itself. Very shortly cooking will be doing the same. Auto recommendation from consumer to consumer already is beginning to do more than it is within my power to do.

L. L. Robinson,
Borough Electrical Engineer.

Hackney, *October 13th*, 1924.

The Wireless Exhibition.

(Concluded from page 535.)

Falk, Stadelmann & Co., Ltd.

"Efescaphone" receiving apparatus, examples of the "Unit" system and home constructor's sets, were on view; also accessories, the "Vernistat" filament control, and "Andex" accumulators for dull emitter valves.

Burndept, Ltd.

This exhibit consisted of "Ethophone" receiving equipment and accessories. The "duplex" is a two-valve set with a range of 250-5,000 metres, while a series of instruments designed for the more advanced worker comprises the tuner, h.f.2 receiver, and power amplifier, which combination will operate on a wavelength range of from 80 to 25,000 metres. The three parts are obtainable separately, or built into a cabinet of Broadwood design.

Other Exhibitors.

The undermentioned firms were also exhibiting:—

M.O. VALVE CO., LTD.—Valves of all types as made at the Osram Works, which were recently described in our pages.

BRITISH EBONITE CO., LTD.—Ebonite panels and sheets (also in colours), mouldings, &c.

PETO SCOTT CO., LTD.—Valve and crystal sets, amplifiers, wave traps, sets of parts for home assembly, and components.

BEARD & FITCH, LTD.—"Success" accessories.

A. J. DEW & CO.—Valve and crystal sets of various makes; accessories.

BOWYER-LOWE CO., LTD.—Components.

DUBILIER CONDENSER CO. (1921), LTD.—Condensers, grid-leaks, &c.

WATES BROS., LTD.—Crystal sets and accessories.

F. E. WOOTTEN, LTD.—Receivers and parts.

BRITISH L. M. ERICSSON MANUFACTURING CO., LTD.—Microphone transmitters, head- and hand-phones, loud speakers, components.

GENT & CO., LTD.—"Radiomatic" receivers, "Tangent" loud speakers and accessories.

BROWN BROTHERS, LTD.—Receiving sets of various makes and accessories.

A. W. GAMAGE, LTD.—Receivers and component parts.

CHLORIDE ELECTRICAL STORAGE CO., LTD.—High- and low-pressure accumulators.

CABLES & ELECTRICAL SUPPLIES.—Accessories and wire.

RADIAX, LTD.—Receivers and components.

J. J. EASTICK & SONS.—Various specialities.

O. A. VANDERVELL & CO., LTD.—Loud speakers and batteries.

A. C. COSSOR, LTD.—Valves of various types.

AUTOVEYORS, LTD.—Receiving sets and specialities.

EAGLE ENGINEERING CO., LTD.—"Chakophone" valve and crystal receivers and components.

REES, MACE MANUFACTURING CO., LTD.—Portable valve receiving sets.

MR. E. A. TAYLOR.—Cabinet receivers.

NATIONAL WIRELESS & ELECTRIC CO.—Receivers and specialities of various sorts.

HART ACCUMULATOR CO., LTD.—High- and low-pressure accumulators.

RADIOPHONES, LTD.—Receivers and "Listoleon" accessories.

In conclusion, attention may be directed to the recent statements of Lieut.-Col. Tatton, of the Federation of British Music Industries, in the *Evening News*, to the effect that "It is undoubtedly true that the concerts broadcast by wireless have helped to stimulate this zest for gramophones and player and other pianos which can be controlled by the people themselves. Wireless has not been at all inimical to the musical instrument trade—quite the contrary."

New Igranic Devices.

During the run of the Wireless Exhibition the Igranic Electric Co., Ltd., had on view a special display of their well-known radio apparatus at Kensington Palace Mansions. Amongst the novelties shown were an improved pattern of the company's shrouded intervalve l.f. transformer; fixed-capacity condensers of numerous capacities, with metallic shield; a variable condenser with vernier, worked with one knob; a variable grid leak; gimbal-mounted coils with vernier adjustment; the "Unitune" aperiodic fixed coupler, in two sizes, major and minor; and a new variometer, type "B," which appears to be "wound on air," the coils, spherical in shape, having no obvious means of support. Various improvements have been introduced in the construction of the honeycomb duolateral coils, increasing their rigidity, as well as in the design of other components.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1923.

10,345. "High-frequency alternators." N. Oboukhoff. April 16th, 1923. (221,837.)

10,351. "Dynamo-electric machines." British Electric Plant Co., Ltd., and A. W. Maudling. April 16th, 1923. (221,838.)

13,136. "Electric immersion heaters." C. R. Belling. May 16th, 1923. (221,842.)

13,255. "Electric motors." H. V. Higgitt and Eastern Telegraph Co., Ltd. May 17th, 1923. (221,844.)

15,306. "Rectification of alternating current." E. Y. Robinson. June 12th, 1923. (221,850.)

15,309. "Vacuum electric tubes." E. Y. Robinson. June 12th, 1923. (221,851.)

15,509. "Vacuum electric tubes." E. Y. Robinson. June 14th, 1923. (Cognate application 15,902-23.) (221,854.)

15,510. "Vacuum tubes." E. Y. Robinson. June 14th, 1923. (Addition to 195,691.) (221,855.)

15,521. "Telephonic receivers." E. A. Graham. June 14th, 1923. (Cognate application 28,975/23.) (221,856.)

15,703. "Electric lamps, more particularly for use on motor vehicles." A. Kelly. June 16th, 1923. (221,858.)

15,810. "Telephone earpieces." J. Wace. June 18th, 1923. (221,862.)

15,856. "Electric switches." Cable Accessories Co., Ltd., and A. Crawford. June 19th, 1923. (221,866.)

15,893. "Wireless receiving sets." Western Electric Co., Ltd., and G. H. Nash. June 19th, 1923. (221,868.)

15,894. "Telephone systems." Western Electric Co., Ltd. (G. Deakin). June 19th, 1923. (221,869.)

16,066. "Electric coupling devices." R. Whaley and T. W. Carradus. June 21st, 1923. (Cognate application 8,052/24.) (221,872.)

16,146. "Insulating protecting covers for conductor rails for electric railways and the like." E. H. Smythe and Electrical Improvements, Ltd. June 21st, 1923. (221,875.)

16,152. "Compensation of variations in the periodicity of vibrating reeds or the like. H. V. Higgitt and Eastern Telegraph Co., Ltd. June 21st, 1923. (221,876.)

16,178. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. August 25th, 1922. (202,963.)

16,258. "Electrical relays." Western Electric Co., Ltd. (L. J. J. Schreiber). June 22nd, 1923. (221,879.)

16,273. "Electric switching apparatus." Relay Automatic Telephone Co., Ltd., and F. M. Ward. June 22nd, 1923. (221,881.)

16,360. "Interlocked fastening devices, particularly applicable to electrical apparatus." A. Reyrolle & Co., Ltd., H. J. Fisher, and J. Mirrey. June 23rd, 1923. (221,886.)

16,364. "Systems of electric motor control." British Thomson-Houston Co., Ltd. (General Electric Co.). June 23rd, 1923. (221,887.)

16,365. "Construction of variable air condensers and like instruments and appliances, particularly for use in wireless telephone and telegraph apparatus." Burndept, Ltd., and C. F. Phillips. June 23rd, 1923. (221,888.)

16,372. "Electric welding." E. C. R. Marks (F. Pabst Co.). June 23rd, 1923. (221,890.)

16,375. "Devices for protecting the body against injurious effects from electric influences." E. M. Akers-Douglas. June 23rd, 1923. (221,891.)

17,334. "Electric control systems for electric and other motors." English Electric Co., Ltd., and F. Morris. July 4th, 1923. (221,901.)

17,361. "Coil-holders for wireless signalling systems." Igranic Electric Co., Ltd., A. H. Curtis, S. R. Wright, and A. H. Mackley. July 4th, 1923. (Addition to 206,899.) (221,902.)

18,128. "Electric lampholder adaptors and the like." J. H. Collie. April 9th, 1924. (221,910.)

18,687. "Terminals or connections for electric conductors." J. S. A. Walsh. July 20th, 1923. (221,914.)

19,455. "Telephone exchange systems." Coventry Automatic Telephones, Ltd. (R. C. Arter). July 30th, 1923. (221,619.)

19,811. "Loud-speaking telephones." W. Clark. August 2nd, 1923. (221,923.)

21,271. "System of wireless control." Vickers, Ltd., and C. P. Ryan. August 22nd, 1923. (221,932.)

21,372. "Electromagnetic devices." Western Electric Co., Ltd. September 18th, 1922. (Patent of addition not granted.) (204,028.)

22,153. "Crystal rectifiers for wireless reception." F. W. Cox, C. Arrigoni, and J. Arrigoni. September 3rd, 1923. (221,943.)

22,474. "Electromagnetic relays." British Thomson-Houston Co., Ltd., and A. S. Fitzgerald. September 6th, 1923. (221,946.)

22,932. "Head-telephone sets." British Thomson-Houston Co., Ltd., and A. T. Stace. September 12th, 1923. (221,949.)

23,288. "Circuits of wireless receiving apparatus." Cooke & Whitfield Wireless, Ltd., and H. H. Whitfield. September 18th, 1923. (221,951.)

23,459. "Ignition magnetos." M.-L. Magneto Syndicate, Ltd., and E. A. Watson. September 19th, 1923. (221,954.)

27,672. "Electric motors operating on pulsatory or single-phase alternating current." C. Fontana and V. Ferrari. November 3rd, 1923. (221,991.)

28,402. "Starting resistances for electric motors." O. Kiaerbye. November 10th, 1923. (221,995.)

29,403. "Holders for electric incandescent lamps." B. Scherer. November 22nd, 1922. (207,533.)

31,020. "Means for supplying current to rare gas electric discharge tubes." G. Claude and J. M. E. de Beaufort. January 22nd, 1923. (210,053.)

31,392. "Electric furnace." B. M. S. Kalling. December 13th, 1923. (222,008.)

32,495. "Electric controlling switches." D. Danielsson and Allmanna Svenska Elektriska Aktiebolaget. December 29th, 1923. (222,011.)

1924.

48. "Cathode structures for vacuum thermionic tubes." Westinghouse Electric & Manufacturing Co. January 8th, 1923. (209,415.)

3,201. "Telephone instruments." Western Electric Co., Ltd. February 7th, 1923. (211,141.)

3,546. "Subaqueous sound-receiving apparatus." Walker Signal & Equipment Corporation and W. L. Walker. February 11th, 1924. (221,727.)

4,589. "Flat electric cables." International Electric Co., Ltd. (Akt. Ges. Mix & Genest Telephon und Telegraphen Werke). February 22nd, 1924. (222,032.)

14,886. "Apparatus adapted to operate as an electric generator and engine starter." L. Lanquetin. August 25th, 1923. (Divided application on 21,557/23.) (222,065.)